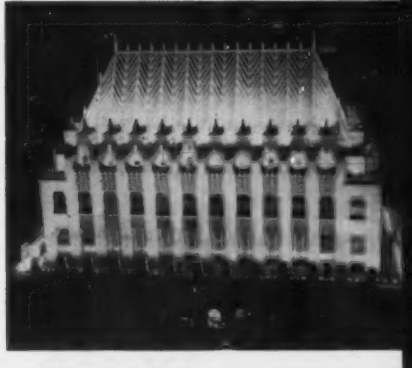
The Electrical Industry's Weekly Magazine

July 21, 1958

Electrical World

Price 50 Cents

A McGraw-Hill Publication



Lighting Promotion:

Utilities Look Again at Their Birthright Page 61

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E B POWER GS
UNIVERSITY MICROFILMS
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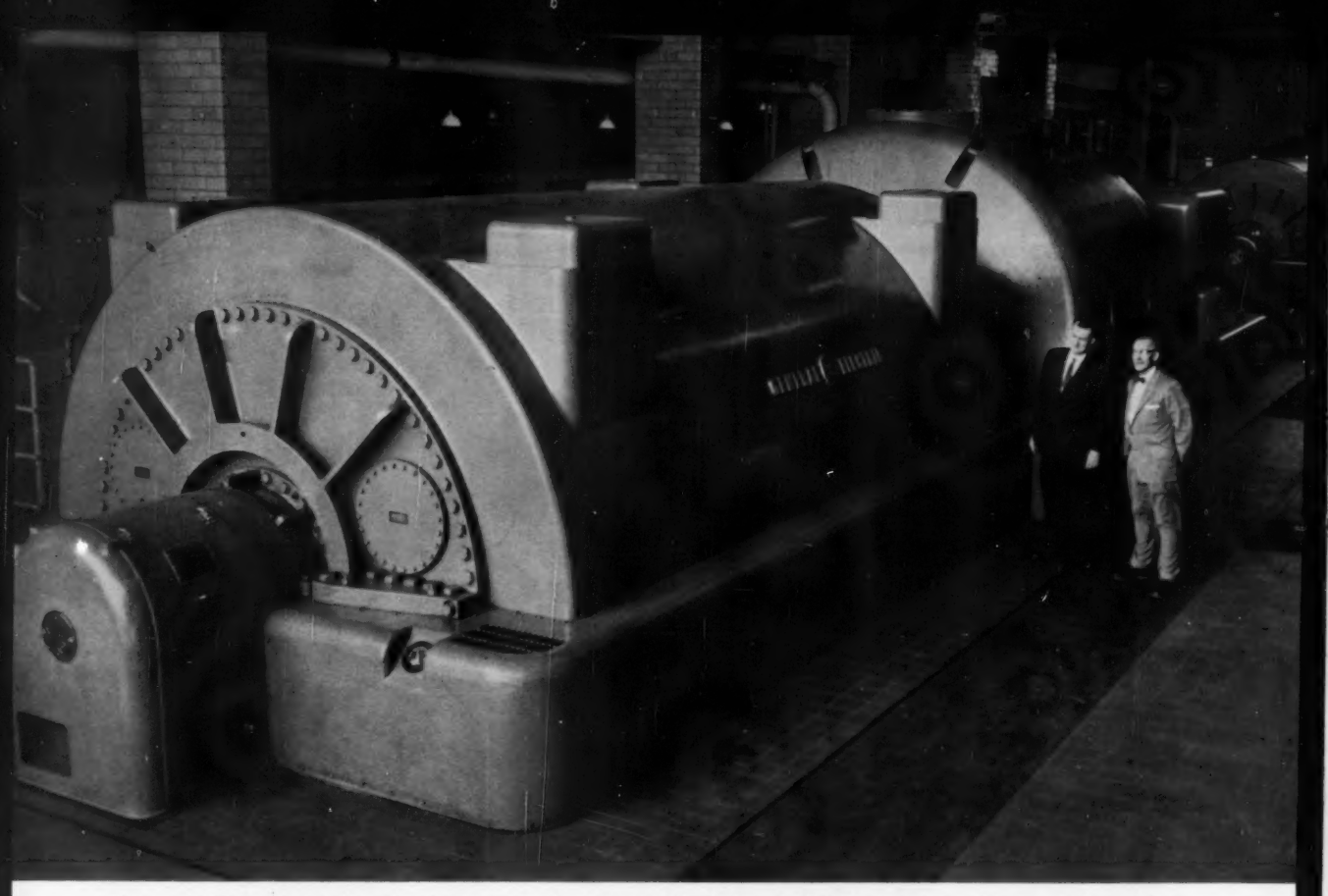


This new 70,000 kw reheat turbine—like all other turbines in this plant—is 100% Texaco-lubricated to keep it free from rust, sludge and foam.

A large Eastern Utility found:

Texaco gives these 3 big benefits for complete turbine protection:

1. Unquestionable dependability. Texaco Regal Oil R&O keeps the utility's turbine system clean; prevents rust, sludge and foam from forming; keeps bearing temperature normal and governor response instantaneous. Texaco dependability is a *fact* for this utility, based on long experience.

2. High efficiency. Texaco Regal Oil R&O assures smooth performance and freedom from unscheduled outages. Texaco Regal Oil R&O gives bearings full protection throughout an extra-long oil service life.

3. Technical service. Texaco offers this important benefit at a time when power demands are almost out-growing turbine production. Past experience in the power plants has proved Texaco Lubrication Engineering Service to be quick and reliable. This service is always available to Texaco customers—whatever the need.

There is a complete line of Texaco Regal Oils R&O to meet the requirements of all leading turbine manufacturers, regardless of turbine type or size. Let a Texaco lubrication expert help you select the Texaco Regal Oil R&O that will keep turbine efficiency high and maintenance costs at a minimum. Just call the nearest of the more than 2,000 Texaco Distributing Plants in the 48 States—or write:

The Texas Company, 135 East 42nd Street, New York 17, New York.

LUBRICATION IS A MAJOR FACTOR IN COST CONTROL

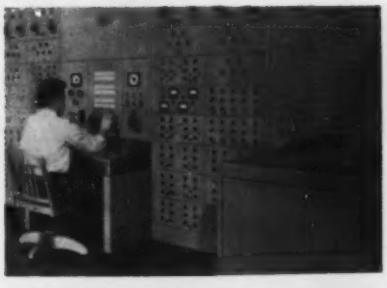
(PARTS, INVENTORY, PRODUCTION, DOWNTIME, MAINTENANCE)

Electrical World

Vol. 150, No. 3 JULY 21, 1958

Published for 84 years for those engaged in the business of generating, transmitting, distributing, or applying electric power

In This Week's Issue



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CURRENT EVENTS

How Atom Figures in Utility Outlook

National Planning Association's study forsees doubling of energy requirements, 6-mill atomic power by 1980.....p 56

Utilities Puzzle Over Big Outages

Station transformer that failed in New Jersey, statewide blackout in Mississippi are being investigated.....p 59

INDUSTRIAL

Industrials Use A-C Network Board

C. C. Young, J. Dunki-Jacobs, General Electric Co

Article tells when to use network analyzer, where to obtain services, and how analyzer works.....p 88

GENERATION

Heat Gives Electricity Directly

Thermo-electron engine developed which produces small quantities of electricity with 12% efficiency.....p 87

A Survey Report

LIGHTING: Utilities Look to Birthright

EW's survey of 50 utilities indicates renewed interest in lighting promotion, more salesmen per prospect, more training for the salesman. But there are weak spots too....p 61

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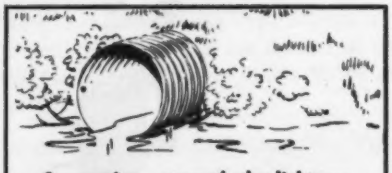
In Idaho Power's brand new East Gate Substation at Twin Falls, Idaho, CM-OT control cable is used on control circuits involving transformers, regulators, metering devices and circuit breakers. Much of the equipment is located in the yard, with cables going underground and up into the main control board.

"We expect 30 years' service from this direct-burial cable," says Idaho Power Company

On its substations along the Snake River, Idaho Power Company uses a direct-burial cable that eliminates the need for conduit or pipes . . . provides complete resistance to soil alkalinity, severe temperature fluctuations and active rodents, as well as excellent mechanical protection.

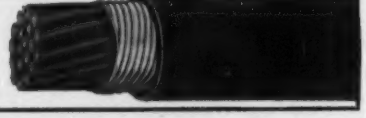
It's Okonite's Watertite-Okoprene control cable with CM-OT* finish—a lightweight, flexible cable of great compressive strength. Heart of CM-OT construction is a corrugated bronze tape that gives unusually high compressive strength. The corrugated tape is bonded to a tough wall of Okoprene, reinforced by an Okoprene-filled tape overall. This composite covering provides a permanent barrier against rodents, moisture, soil alkalies, acids, oils, sunlight or mechanical damage.

It will pay you to learn more about CM-OT quality cable constructions with corrugated bronze tape protection. Send for Bulletin EW-1121, The Okonite Company, Passaic, New Jersey.



Corrugation = strength plus lightness

Just as corrugated construction adds strength to underground pipes, so corrugation of shielding tape permits the construction of CM-OT—the stronger, lighter, more flexible and more easily handled cable.



* Patent No. 2722562

where there's electrical power . . . there's **OKONITE CABLE**

6201

Ten Years of Progress

Last week the writer of this column celebrated his tenth anniversary with Electrical World. Looking back over that period, one sees a decade of progress by the utilities which would be difficult to match by another industry.

Just picture an industry that has more than doubled its capacity and its production with less than a 10% increase in employment.

System facilities are being built at about the same cost per kilowatt as they were ten years ago. And the average cost of electrical energy has steadily declined.

The utilities have solved their problem of growth, put their management house in order, and learned to plan well in advance of need.

It is a pleasure to view this ten years of progress and congratulate the industry.

And we humbly believe and are proud of the fact that we are due some small share of credit for this record of progress.

Fischer Black

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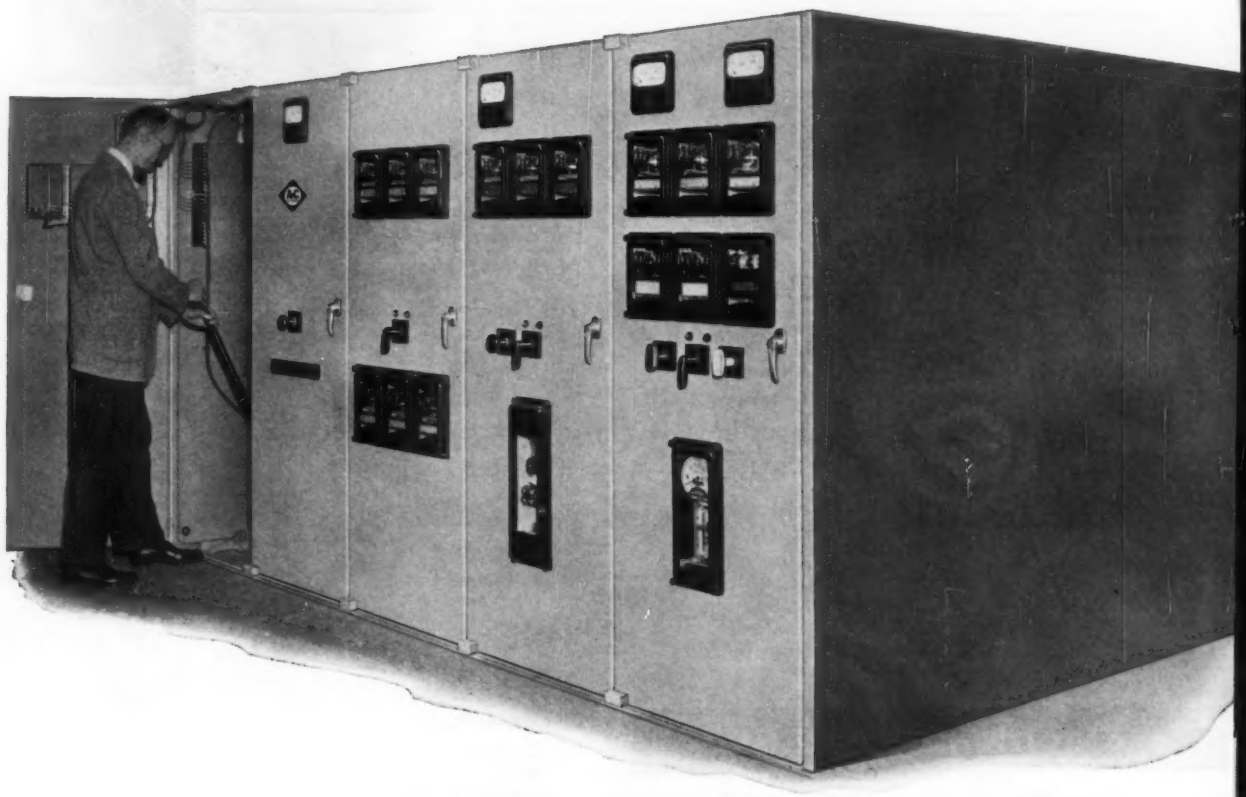
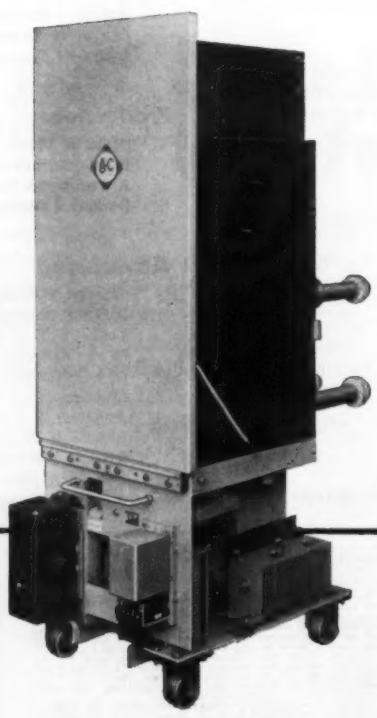
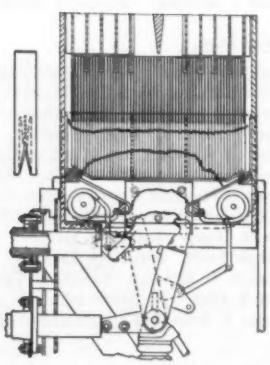
For Progress in





Self-contained breaker control . . . removing breaker from unit removes all cooperating elements for testing to simulate service conditions. Automatic-locking steel barrier provides maximum protection with double steel walls between operator and interrupter.



Horizontal contact separation takes full advantage of thermal effect of arc. Two blowout coils per phase produce magnetic field for fast arc extinction. Puffers accelerate low current interruption.

ALLIS-

Switchgear

NEW

low silhouette ...new advances

Allis-Chalmers 4.16 kv horizontal-drawout metal-clad switchgear offers latest convenience, safety and engineering advances

Let's start with the new 72-inch silhouette — the lowest in the industry. It means eye-level instrumentation plus shoulder-height accessibility of auxiliary equipment. The Allis-Chalmers "new" look is the right look with the right approach to operating problems.

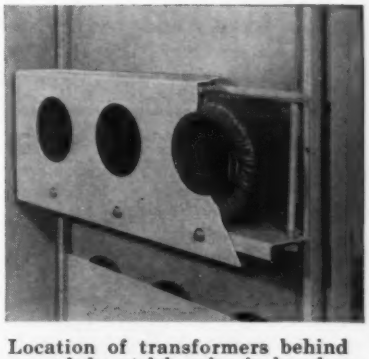
Maximum Compartmentation — This new Allis-Chalmers switchgear is the most completely compartmented switchgear available. Current transformers can be mounted on bus or load side in standard unit. All circuits are segregated... all live parts are completely enclosed... all metal barriers are grounded. Full interlocking further insures operator safety.

Quick "one-stroke" insertion of *Ruptair* breakers takes less than 15 seconds from the fully disconnected to the connected position. The *Ruptair* breaker is available for all applications — 2 or 5 cycle operation, 75, 150, 250 or 350 mva, and 1200, 2000, or 3000 amperes continuous.

Get Literature — Contact your nearby Allis-Chalmers office for further information, or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.

It takes less than a minute to install a molded glass polyester cover over a bus joint to join shipping groups in the field. No taping, no messy compounds... another exclusive feature.

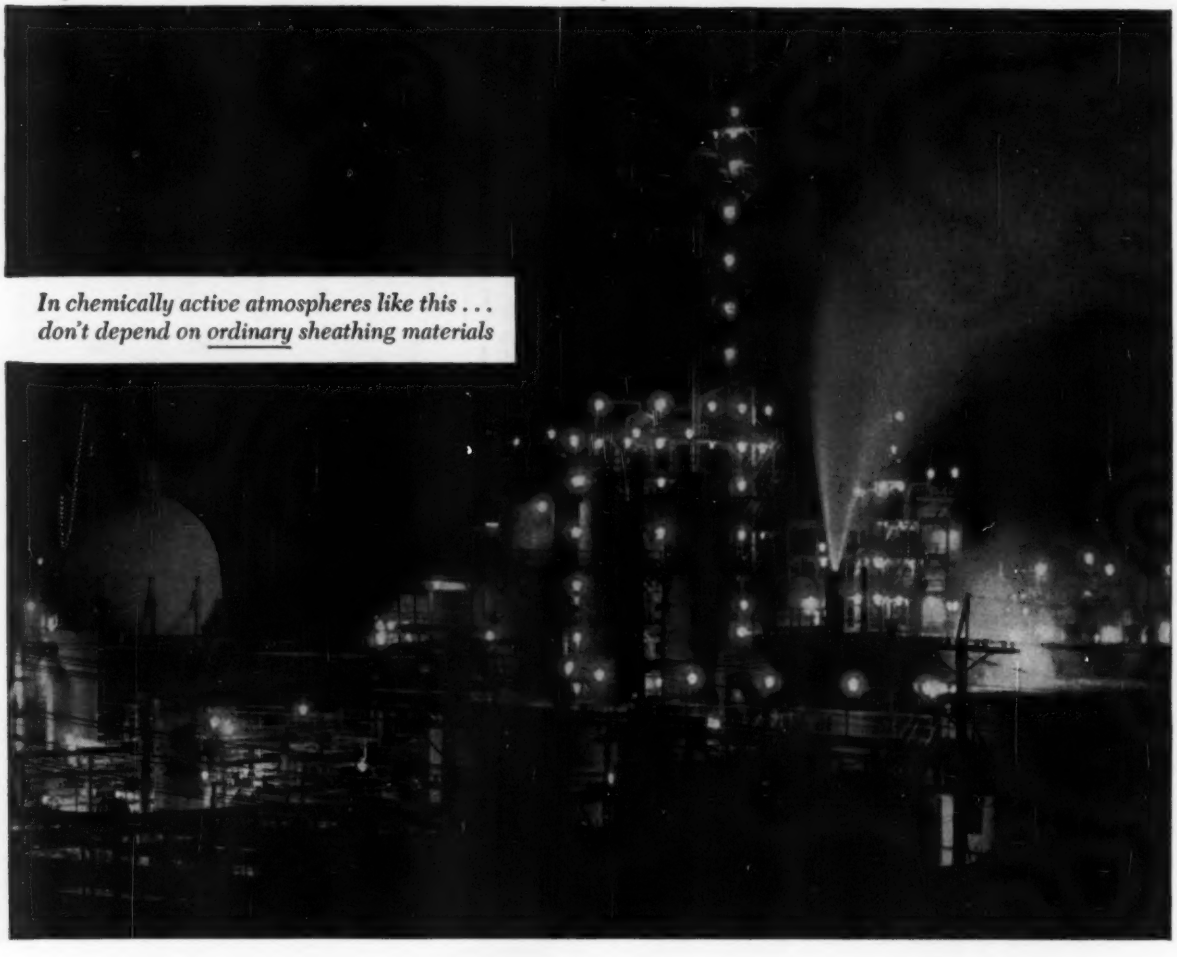
There's shoulder height accessibility of potential transformers whether mounted in top rear of standard unit or auxiliary unit. Three cast epoxy resin PT's may be mounted on one safe tilt-out carriage.



Location of transformers behind grounded metal barrier in breaker compartment in front of automatic shutters provides maximum operator safety for test and replacement.

Ruptair is an Allis-Chalmers trademark.

CHALMERS A-C ALLIS-CHALMERS A-5777



In chemically active atmospheres like this . . . don't depend on ordinary sheathing materials

Continuity of power service often demands corrosion-resistant cable sheaths . . . like Roseal

What happens when your power cable in a refinery, steel mill, paper mill, or chemical processing plant fails from the deterioration caused by a highly corrosive atmosphere? You pay to replace the cable, your customer complains about downtime, and most important—*you lose power revenue.*

Now you can avoid power service interruptions in areas like those where the increased likelihood of cable breakdown presents a real problem. A new flame-retardant polyethylene compound—developed by Rome Cable—provides the kind of protective sheath you need in critical areas with oxidizing and corrosive atmospheres.

Tough new sheath

Called *Roseal,* this new sheathing compound makes long, uninterrupted service possible where heat, oils, acids, most chemicals, moisture, and oxidizing and corrosive atmospheres exist. Here's why:

1. Roseal resists oils, moisture, and most chemicals *even better than conventional nonmetallic sheathed cables.*
2. Its moisture-resistant characteristics are superior *to all other types of nonmetallic sheaths.*
3. Its flame retardance meets U/L original horizontal flame-test requirements.

Low-cost dependability

As an added benefit, in addition to its excellent properties, Rome's Roseal generally costs less than thermosetting sheaths. Roseal-sheathed cables are available with either aluminum or copper conductors and many types of insulations, including Rome's ozone-resistant oil-base (Rozone) or butyl-base (Rozone A) insulations. You can get single-conductor Roseal-sheathed cables in a variety of sizes from No. 8 AWG to 1,000 MCM, with grounded or ungrounded neutral, in standard voltage ranges from 3 to 15 KV.

For more information, contact your nearest Rome Cable representative—or write to Department 718, Rome Cable Corporation, Rome, New York.

FREE: New Technical Bulletin—describing in detail Rome's shielded high-voltage power cables—sheathed with thermoplastic Roseal—is now available. Just write for Bulletin RCD-700.

ROME CABLE
CORPORATION

NOW...

double barreled performance

WITH THE ALL NEW AMP UTILI-TAP TEAM

The unique double barreled UTILI-TAP connector and matchmated tools offer a completely new and easy way to secure conductors at both ends of the service drop, at transformers and loop splices. No loose-piece hardware to fumble with, no periodic tightening or arm-wearying tooling. The UTILI-TAP team means maximum performance and long life, with greatest ease of application.

The UTILI-TAP Connector features:

- exclusive double barreled **locking crimp**—to guard against relaxation under varying load conditions
- **tin-plated** to resist corrosion and assure optimum electrical connection
- **pre-inhibited** with non-flow compound to remove oxide from aluminum conductors

The UTILI-TAP Tool features:

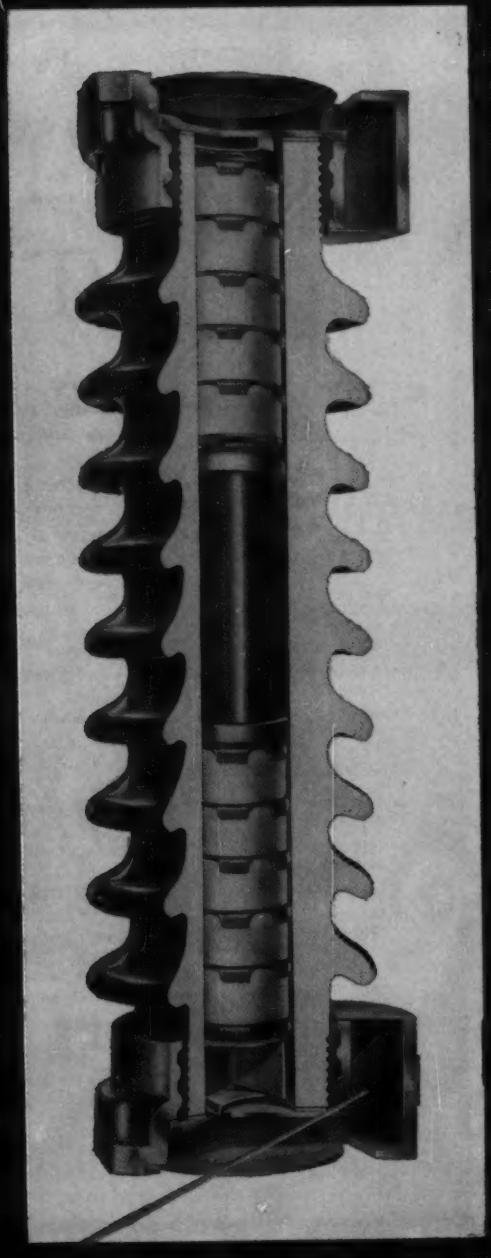
- crimping dies are permanently attached to tool head for quick die change
- open type head for easy access to conductor and quick release after application
- portability—lightweight (less than 8 lbs.)
- for wire size range 8 through 4/0 AWG—solid, stranded and ACSR—in all copper and aluminum wire combinations

For more information on the double barreled UTILI-TAP method, write:

American Pamcor, Inc. api

GENERAL OFFICES: 181 HILLCREST AVE., HAVERTOWN, PA.

EXCLUSIVE DISTRIBUTORS FOR AMP PRODUCTS TO THE UTILITY INDUSTRY



Exclusive Westinghouse venting transfers arc outside in less than $\frac{1}{2}$ cycle.

FROM PLOWBACK OF EARNINGS INTO RESEARCH

ARRESTER EXPLOSION PREVENTED BY ARC TRANSFER

Westinghouse engineers developed a unique arc transfer method which completely eliminates the possibility of arrester explosion and the resulting damage.

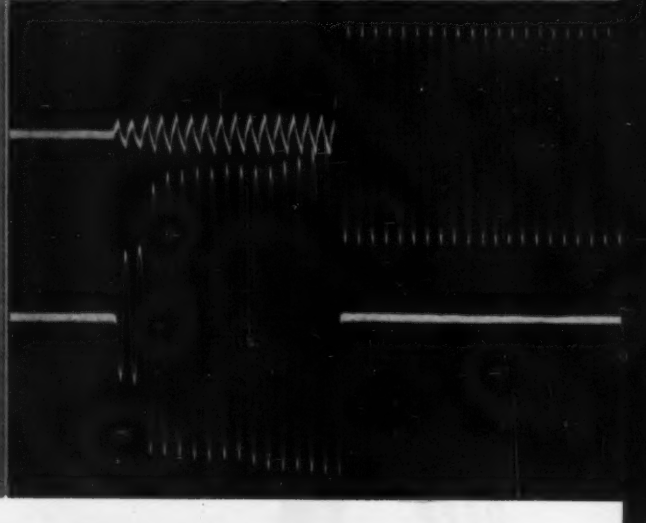
If an arrester does not clear the power follow-current after sparkover, full system short circuit current will flow through the device, with the resulting build-up of tremendous pressure. Unless this pressure is stopped within ½ cycle, the arrester will explode and damage adjacent equipment. Westinghouse engineers in 1950 combined a rupturing diaphragm with exhaust ports which transfer the arc to the outside of the porcelain in less than ½ cycle.

In 1954, after four years of perfect field trials, Westinghouse began applying this pressure relief device to all station arresters.

For complete information about the extra margin of safety in Westinghouse station arresters, call your Westinghouse sales engineer or write to Westinghouse Electric Corporation, P.O. Box 868, Pittsburgh 30, Pa.

J-60947

Illustration shows fractured diaphragm of arrester purposely damaged at High Power Lab to create high gas pressure. Vents at either end of the arrester units direct the gas, after rupture, to the outside of the porcelain . . . this path of ionized gas requires considerably less voltage to maintain the arc than in arrester interior . . . thus the arc is transferred outside to the ionized path created by the gas jets. Action requires less than ½ cycle from onset of full fault current.

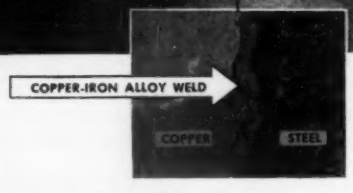


Oscillogram illustrates action during high fault on damaged SV station arrester equipped with the Westinghouse pressure relief device. After surge was applied to arrester, 42,000 amperes rms of short circuit current started to flow through the unit, and voltage dropped to about 33% of normal crest. After about *15% of one cycle*, voltage dropped to steady-state a-c arc voltage . . . indicating that ionized gases conducting the arc merged outside the arrester porcelain.

YOU CAN BE SURE...IF IT'S Westinghouse

EVERY COPPERWELD GROUND ROD is

molten-welded



This microphotograph of the Molten-Weld shows how the grains of copper and steel interlock to form a permanent, continuous weld. No other process achieves this inseparable union.

WHAT'S THE ADVANTAGE?

By this unique Molten-Welding process—used only by Copperweld Steel Company—a uniformly thick sheath of pure copper is inseparably welded to an alloy steel core. Under carefully controlled conditions, the grains of both metals interlock to form a permanent, continuous weld. And from the moment of this union, Copperweld* performs as one metal. Hot rolling, cold drawing, temperature changes, pounding, or abuse cannot destroy the Molten-Weld in Copperweld Ground Rods.

WHAT DOES THE MOLTEN-WELD IN COPPERWELD MEAN TO YOU?

In service, this permanent Molten-Weld completely eliminates the possibility of harmful electro-galvanic action in the presence of moisture. There are no microscopic cracks, fissures, or pin holes in the thick copper exterior to admit moisture and give destructive rust a foothold.

So, for permanent grounding protection at lowest annual cost, insist upon Copperweld Ground Rods and get the rust resistance and conductance of copper plus the strength and easy-driving qualities of alloy steel. The time-tested dependability and economy of Copperweld products have been proved in service for over 40 years. *Trade Mark

COPPERWELD STEEL COMPANY WIRE AND CABLE DIVISION *Glassport, Pa.*

For Export: COPPERWELD STEEL INTERNATIONAL COMPANY, New York

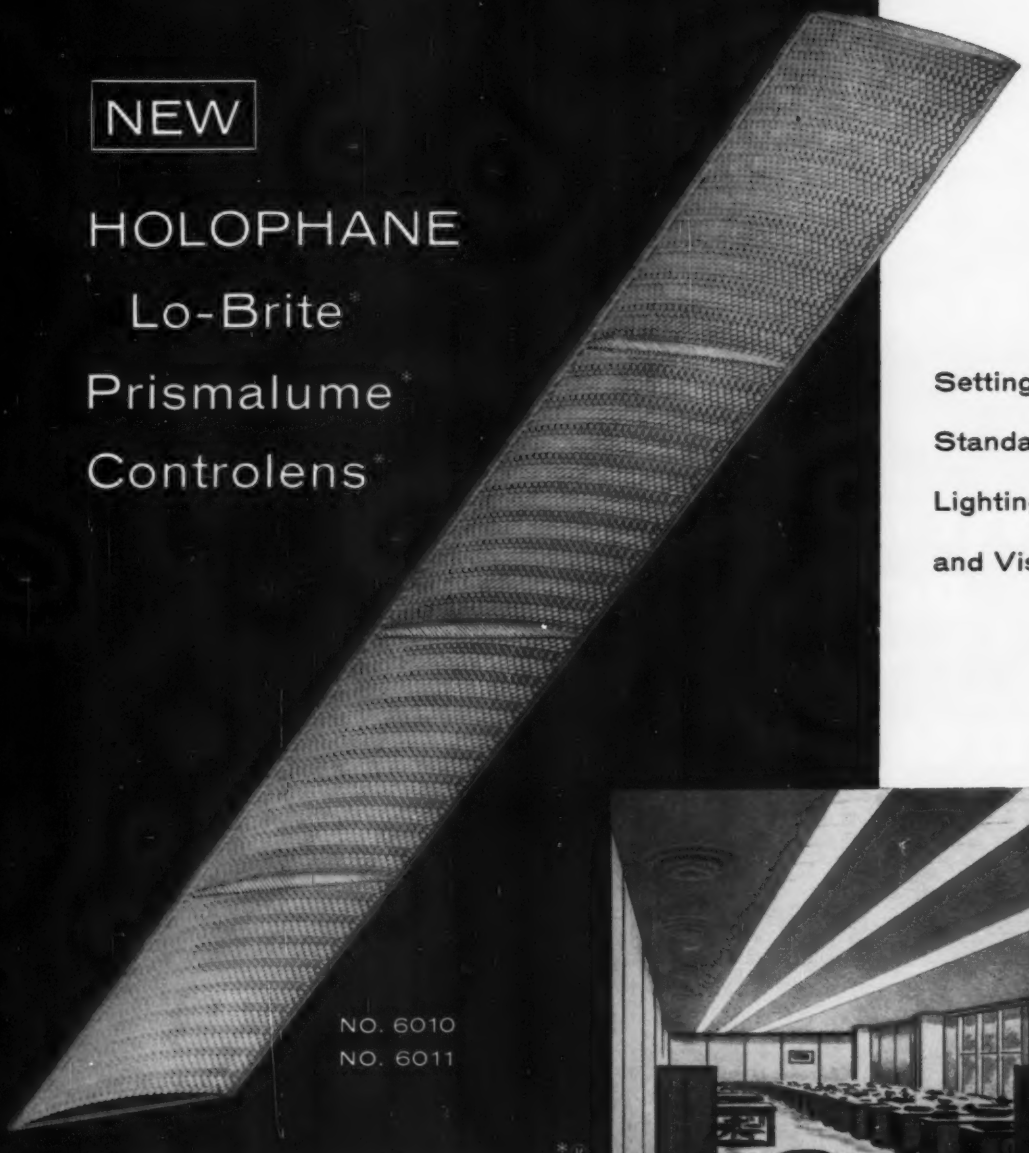
DRIVE DEEP with Copperweld TRADE MARK sectional ground rods

FOR low resistance THE YEAR 'ROUND

NEW

HOLOPHANE

Lo-Brite®
Prismalume®
Controlens®



Setting New High Standards of Lighting Efficiency and Visual Comfort

- **One Piece— 4-Foot Length...**
- **Prismatic Acrylic Plastic...**
- **Unique Concave Shape...**
- **For 1-Foot-Wide Fluorescent Luminaires**

This new 4-foot Holophane CONTROLENS offers advantages that are years ahead—that set it apart from ordinary diffusing elements... Made of crystal-clear acrylic plastic... light in weight ... free from discoloration... retains its shape... Its prismatic construction and concave contour assure exceptional lighting performance — directing maximum illumination to desired areas, minimizing brightness and glare... Modern and streamlined in design, it enhances the distinction of offices, banks, stores, showrooms — wherever the finest fluorescent lighting is indicated... Holophane lens distributors provide luminaires carrying these CONTROLENS. Specify 6010 for plaster and concealed T-Bar ceilings; 6011 for inverted grid ceilings.

For Better Lighting Holophane *...Be Specific*

Write today for engineering data and list of franchised lens distributors

HOLOPHANE COMPANY, INC.

Lighting Authorities Since 1898 • 342 MADISON AVENUE • NEW YORK 17, N. Y.

THE HOLOPHANE CO., LTD., 418 KIPLING AVE. SO., TORONTO 14, ONTARIO

PRE-ASSEMBLED DOUBLE CIRCUIT INTEGRATED SUBSTATION

THE FIRST INTEGRATED SUBSTATION is operating at Thorntown, Indiana . . . developed by the Public Service Company of Indiana, Inc. and Moloney Electric Company . . . designed and built to provide an efficient, economical means of serving outlying areas.

This type of unit has several distinct advantages over conventional methods of substation construction . . .

- Considerably less time is required for erection thereby effecting a saving in field assembly costs and assuring an early in-service date.
- Less handling and storage of materials.
- Engineering and purchasing time are minimized.
- Standard mounting arrangement of the low voltage structure permits replacement of the transformer with a larger unit in the event of future load growth.
- Portability.

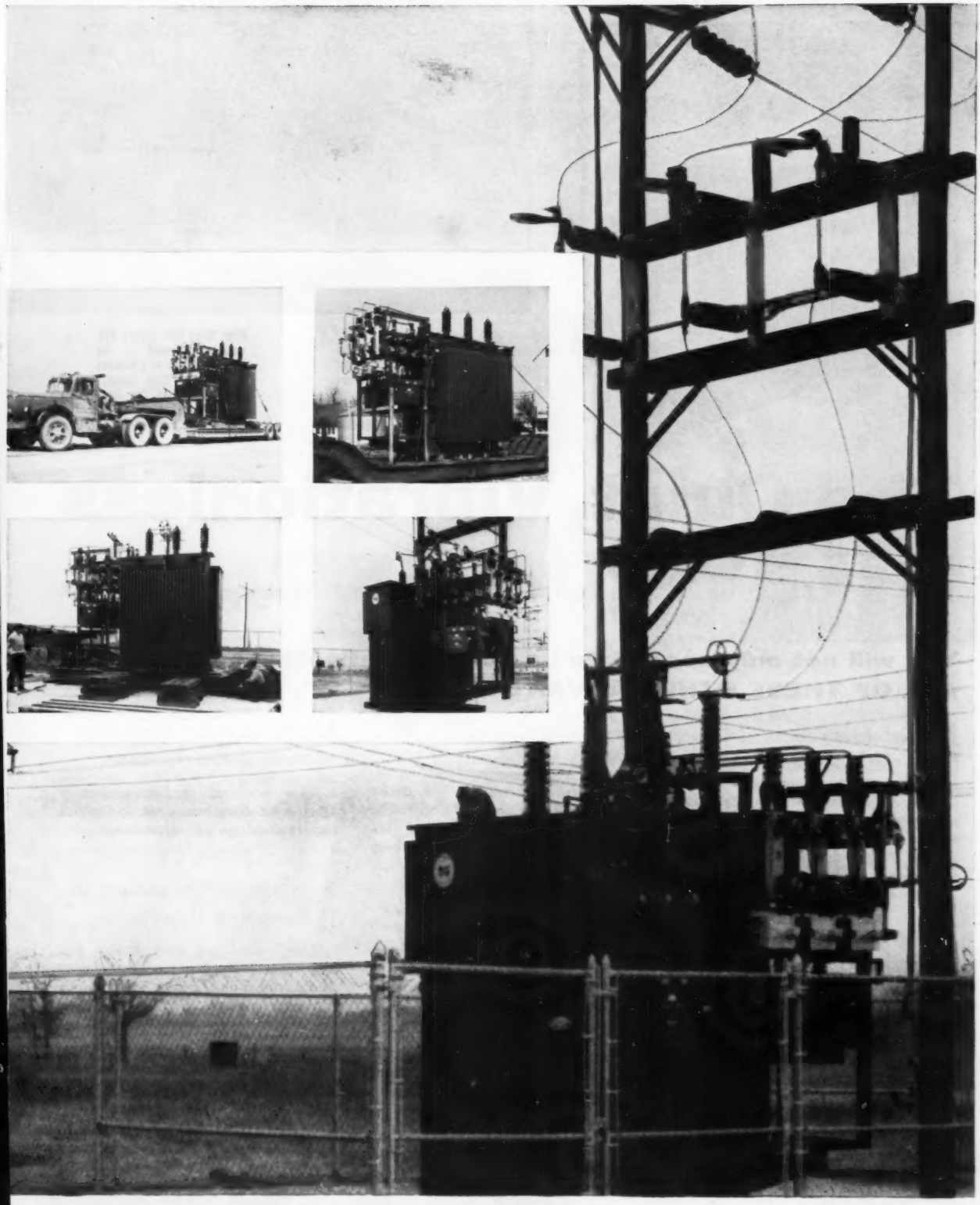
Contact your local Moloney representative for additional information on the Integrated Substation.

MOLONEY ELECTRIC

M O L O N E Y

Manufacturers of

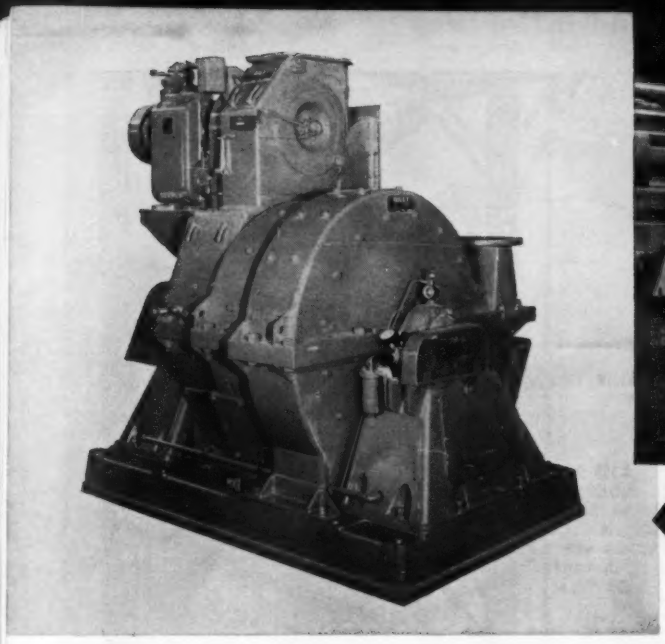
SALES OFFICES IN ALL PRINCIPAL CITIES



E L E C T R I C C O M P A N Y

Transformers for Utilities, Industry, and Electronic Applications

FACTORIES AT ST. LOUIS 20, MO. AND TORONTO, ONT., CANADA



Latest model Riley #350 Pulverizer with Metering Coal Feeder which has a magnetic separator to remove metals escaping the conveyor magnets.

Four Riley 550 Duplex Pulverizers installed in the Picway Station of Columbus & Southern Ohio Electric Co. — one of the many Public Utilities that are using Riley Pulverizers.

The Quiet, Vibrationless RILEY PULVERIZER is

You will not only appreciate its quiet, vibrationless operation but ALL OF THESE OTHER ADVANTAGES:

Dependability

Riley "50" Series Pulverizers are rugged in construction, simple in design concept. All moving parts are on a single shaft rotating on two main bearings. They require no worm gears or other complicated mechanisms. A high degree of selectivity of rejection of foreign material prevents damage to pulverizer parts.

Sustained High Fineness

Tungsten Carbide faced pulverizing elements last for years providing a high degree of pulverized coal fineness.

No Loss of Capacity With Wet Coals

Flash drying in crusher-dryer section evaporates all free moisture. Coal can be dripping wet when entering feeders without loss of capacity. Adequate primary air temperature is provided.

Extreme Load Ranges

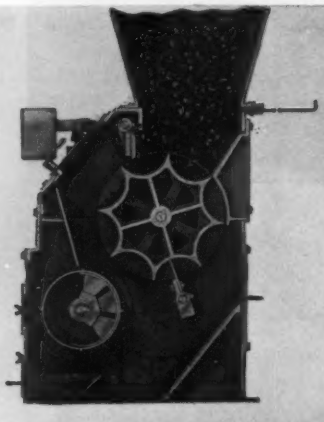
There is no lag with Riley Pulverizers to conform to load changes. Change in feeder rate gives instantaneous change in pulverized coal output.

No Adjustment Necessary to Maintain Fineness

Riley Pulverizers need no springs or other wear compensating devices which require shutdown for adjustment.

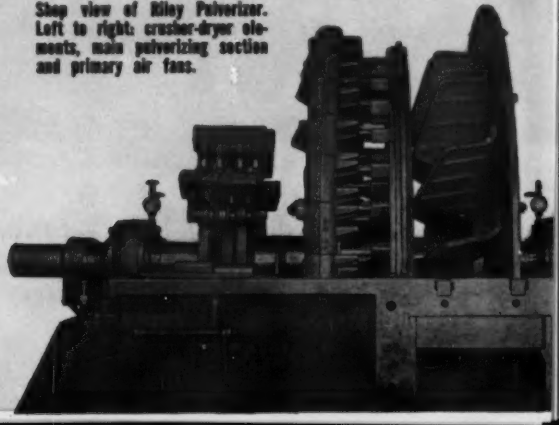
A Minimum Labor Cost in Removing Rejections

Tramp metal and other foreign materials are easily removed thru a door in the crusher-dryer section and thru one in the feeder.

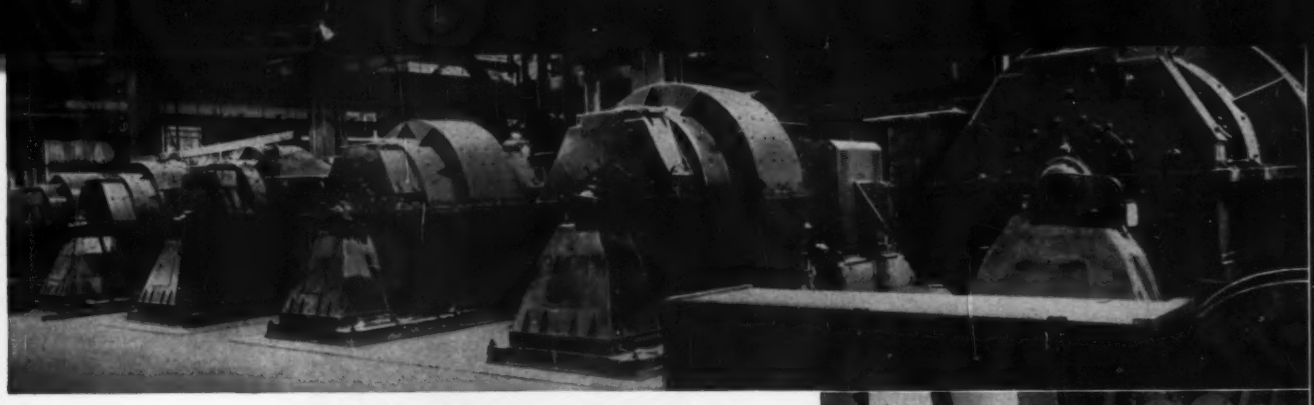


Cross section of Riley Feeder shows how coal is metered and the new magnetic separator.

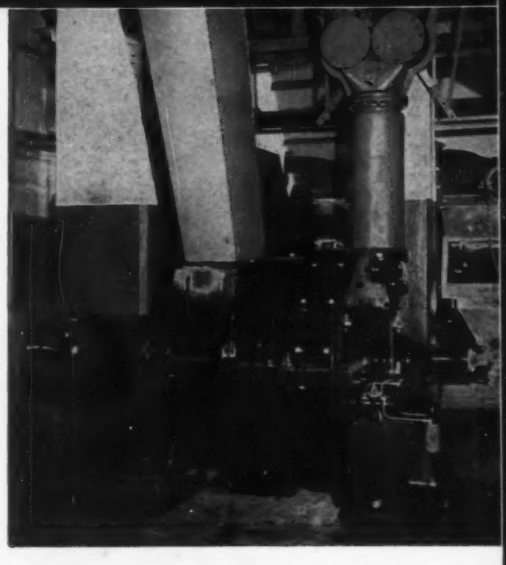
A tungsten carbide faced pulverizing element. Note how carbide completely protects the base.



Shop view of Riley Pulverizer. Left to right: crusher-dryer elements, main pulverizing section and primary air fans.



These six Riley Duplex Pulverizers will supply a 2,000,000 lbs/hr reheat unit at the River Rouge Plant of Detroit Edison Company.



A small #350 Riley Pulverizer installation, typical of hundreds that are operating in industrial power plants with units ranging in capacity from 50,000 lbs/hr up.

Easy on the Nerves!

Ease of Maintenance

All Pulverizer parts are accessible by simply removing top half of housing. Complete replacement of parts can be made in one day. Crusher-dryer parts can be replaced by merely removing separate covers in housing. Bearings for main shaft are only parts to be lubricated.

Ability To Run Without Coal

Because no moving parts are in contact with each other, no damage will occur when operating without coal. Operation is quiet.

Explosion Proof

There has never been an explosion in a Riley Pulverizer under normal operating conditions. Coal travels so fast thru pulverizer that flame can't propagate.

High Primary Air Temperatures Used

Riley Pulverizers operate with discharge temperature normally at 200 F which increases boiler efficiency. Higher temperature aids combustion and lighting of burners.

Ease of Automatic Regulation

Only two adjustments are needed with change of load; (1) coal feed to pulverizer and, (2) air to burners — ideal for efficient automatic operation.

No Auxiliary Air for Sealing

Auxiliary blowers for sealing or for protection of bearings are not required.

Compact and Space Saving Design

Riley Pulverizers occupy the least space per ton capacity of any pulverizer made.

Low Foundation Cost

With no inherent vibration and being the lightest in weight per ton capacity, the foundation does not need to be massive and deep.

Low Power Consumption

Due to the principle of pulverizing in suspension by impact and attrition, power to run Riley Pulverizers is low at all loads.

Ease of Start-Up

The small percentage of primary air, and a uniform distribution of coal from Riley Burners make lighting of burners easy and provide a stable flame at low loads.

Capacities from 3000 lbs/hr to 60,000 lbs/hr

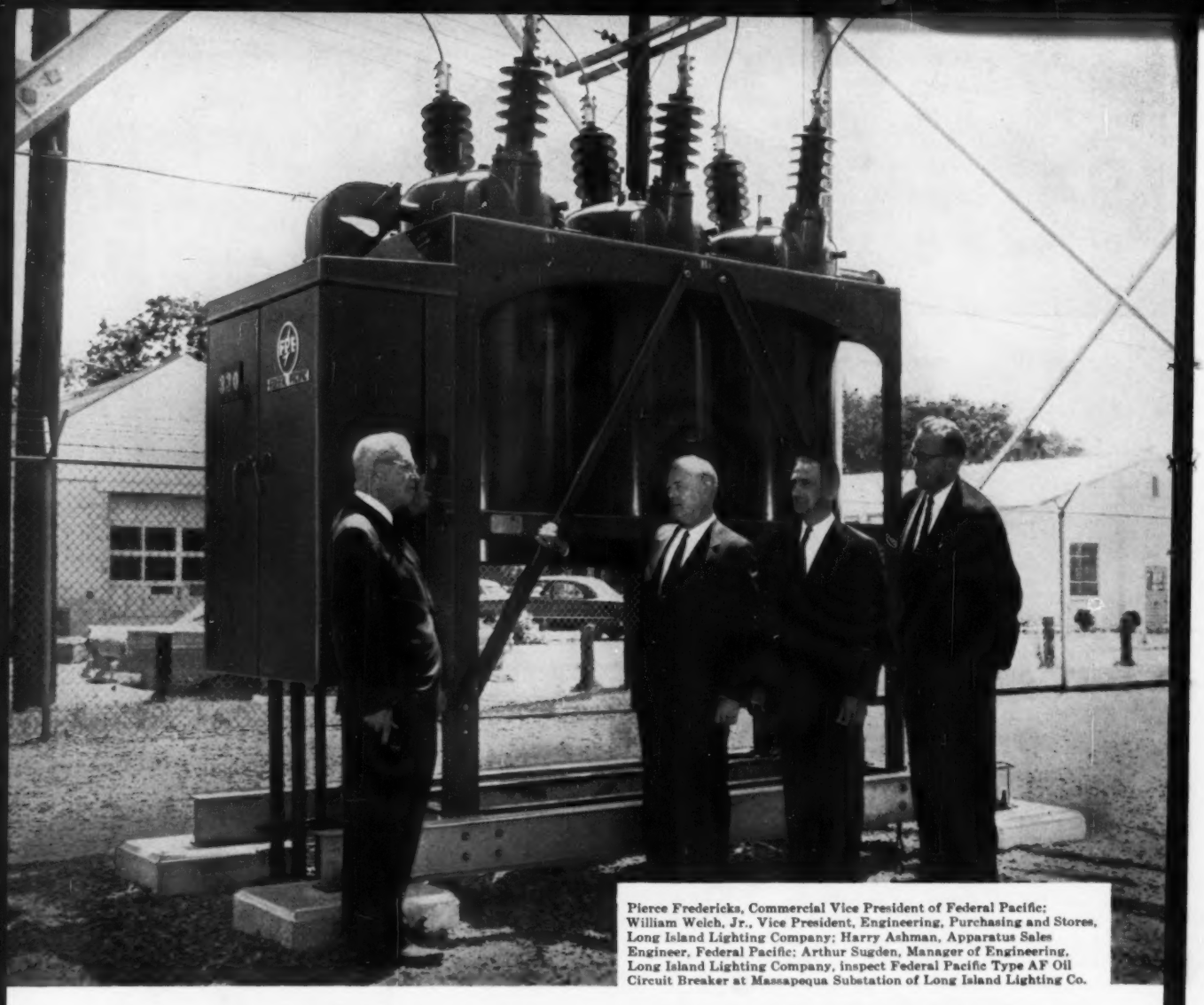
Riley Pulverizers are supplied in a range of capacity suitable for any size of modern boiler.

RILEY

STEAM GENERATING & FUEL BURNING EQUIPMENT

For Complete Riley Pulverizer Details Contact a Riley Office in:

Worcester, Atlanta, Charlotte, Chicago, Cincinnati, Cleveland, Detroit, Houston, Kansas City, Los Angeles, New York, Philadelphia, Pittsburgh, New Orleans, Portland, St. Louis, St. Paul, Salt Lake City, San Francisco, Seattle, Syracuse.



Pierce Fredericks, Commercial Vice President of Federal Pacific; William Welch, Jr., Vice President, Engineering, Purchasing and Stores, Long Island Lighting Company; Harry Ashman, Apparatus Sales Engineer, Federal Pacific; Arthur Sugden, Manager of Engineering, Long Island Lighting Company, inspect Federal Pacific Type AF Oil Circuit Breaker at Massapequa Substation of Long Island Lighting Co.

ANOTHER NEW FEDERAL PACIFIC OIL CIRCUIT BREAKER ON THE JOB

This new 34.5 kv type AF oil circuit breaker is one of many Federal Pacific breakers used by the Long Island Lighting Company. Employed as a line breaker on a sub-transmission line, this type AF breaker—like all Federal Pacific equipment—is ready to perform as specified.

Here are some of the advantages utilities gain by specifying Federal Pacific type AF oil circuit breakers:

RAPID ARC EXTINCTION—extreme simplicity of interrupters...*no* moving parts...superior condensation-type arc extinction principle. Oil injection into the hot gas bubble accelerates condensation and cooling...results in high dielectric recovery rate...prevents arc re-ignition at proper gap distance with minimum pressure build-up and erosion.

TYPE OA HYDRAULIC OPERATING MECHANISM—ultra-rapid response, 100% trip-free under *all* conditions, safe and proven dependable.

HIGHEST MECHANICAL SAFETY FACTOR—demonstrated by an ability to withstand an indefinite number of no-load operations without oil in the tanks. Uses no dash-pots in the tanks.

RIGID FRAME DESIGN—functionally designed frame provides trim lines with exceptionally strong joint construction. Oil gauges and position indicators clearly visible from ground level.

LOW MAINTENANCE COSTS—factors such as the extremely simple method of interruption, the precise positioning of contacts, the overall "built-in" simplicity, result in outstandingly low maintenance needs.

For full details of the many advantages offered by Federal Pacific type AF oil circuit breakers, call your Federal Pacific engineer or write Federal Pacific Electric Company, 50 Paris Street, Newark 1, New Jersey.

FEDERAL FPE PACIFIC

Better Products to Control Electricity

The Electrical Week

FUTURE NEWS ▶ **Look for a private industry group to build a gas-cooled reactor** without government assistance, perhaps in connection with the recently passed House and Senate A-power bills (p 60).

System planning engineers will soon get a helping hand from a digital computer which will not only analyze system conditions, but will also peg "weak spots" in the future system.

LATE NEWS ▶ **REA Deputy Administrator Fred Strong resigned** to return to private public relations practice. His successor has not been named.

TVA's gross sales and net revenues for the first 11 months of fiscal 1958 (7/1/57 to 5/31/58) dipped below those for the same period last year. TVA officials blame a 2½-billion kwhr decline in power use by Federal atomic agencies. Recession role was minor.

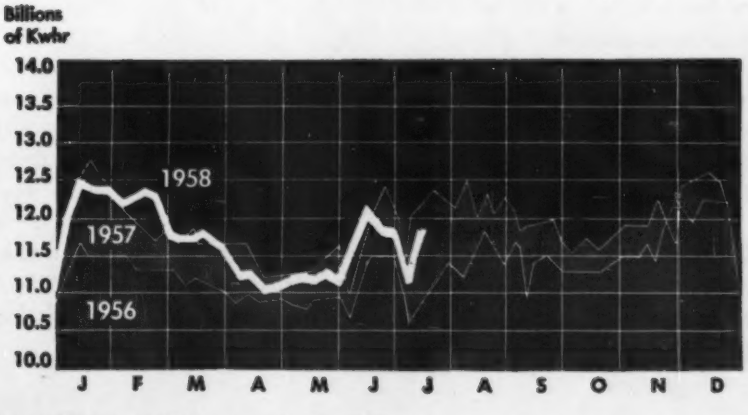
Labor roundup: . . . Central Maine Power and IBEW agreed to a 4% wage hike retroactive to May 1, and another increase (1%) effective Sept. 1 . . . Ohio Edison and UWUA settled on a 5.1% increase . . . Ohio Power made two recent settlements: a 5% jump with its power plant employees on the basis of a wage reopening; and a 5% hike plus improved vacation in a new contract with its operating employees.

GE apparently submitted lowest bid of $1,192,000 for two 200-Mva autotransformers for N.Y. Power Authority's Niagara Project.

Management changes . . . At Boston Edison, T. J. Galligan, Jr, named a vp . . . R. D. Pike elected a vp at Rochester Gas & Electric . . . R. D. Wardle, Jr, assistant to finance vp at Georgia Power, is named a vp of Southern Co . . . F. A. Masterson named vp of A. B. Chance Co.

Obituary . . . N. V. Palmer, Electrical World's Atlantic district manager, died in Hackensack, N. J., July 14.

POWER OUTPUT—Down 0.9% (Week ending July 12), Kwhr 11,851,000,000



Per Cent Change From Previous Year

	June 28	July 5	July 12
Total U.S.	−2.9	+1.4	−0.9
New Eng.	−3.9	+11.8	+3.2
Mid. Atlantic ..	−7.8	+8.8	+4.8
Cent. Ind.	−3.9	+3.5	−1.6
West Cent.	+1.0	−0.4	−4.3
Southeast	−3.1	+1.2	−0.2
South Cent.	+6.4	−3.5	−6.7
Rocky Mount. ..	+4.6	+3.1	+4.9
Pacific			
NW	−11.8	−17.0	−12.6
SW	+0.1	−0.6	+1.6

Seasonally Adjusted Index 226.7
Week Ago 230.0 Year Ago 230.2

Atomic Energy Commission requirements—1,050,000,000 Kwhr (Electrical World Estimate). Excluding AEC, Output decrease was 0.9%.

A TWO-MINUTE PREVIEW OF THIS ISSUE

EVENTS ▶ **Eyes are focusing on assessment and tax structures for utilities.** In Utah, assessment laws favoring co-ops over private electric companies have been declared unconstitutional. In other states new developments are also brewing (p 57).

A fiery explosion shook Public Service Electric & Gas Co's Kearney, N. J. generating plant as 13/132-kv transformer went out of commission, setting off a chain reaction breakdown which left 600,000 customers without electric power . . . Mississippi was left powerless when a sudden, unexpected load was dumped on Mississippi Power & Light Co's system, tripping generators (p 59).

SPECIAL REPORT: LIGHTING ▶ **Utilities are again looking at lighting**—the load which gave the industry its birth—as a load worth promoting. Long neglected for the more "dramatic" loads, lighting, especially in the commercial and industrial markets, is once more being cultivated as a promising revenue booster. An EW survey of 50 utilities tells what is being done about it now (p 61).

ATOMIC ▶ **By 1980 nuclear plants will account for 21% of total generation** in U. S., according to latest National Planning Assn study. Cost will be about 6 mills. Atomic plants will account for three-fourths of all new power plant construction. NPA expects costs of conventional fuels to climb only modestly; therefore, it says, A-power costs will have to be cut drastically. It also sees the six-mill A-power giving industries new freedom in plant location, perhaps revitalizing areas from which industry is now making an exodus (p 56).

GENERATION ▶ **Buck Rogers would have loved owning a thermo-electron engine** which converts heat directly into electricity. MIT researchers have come up with just such a device, which they say can produce 5,000 to 15,000 w per cu ft of plant space, at better than 10% thermal efficiency (p 87).

TRANSMISSION ▶ **Quicksand and floods** will have a tough job toppling a transmission tower recently erected. "Aquajel" was used to stiffen quicksand enough to drill through it to solid earth, then concrete was poured from the bottom of the hole, forcing water up and out, providing a firm tower foundation (p 67).

SUBSTATIONS ▶ **Now you can isolate effects of fluctuating loads** from other loads on same transformer with a specially designed negative reactance transformer. Such fluctuating loads can be handled economically by three or four winding transformers (p 87).

A complete 9,000-kva substation rides the highway on a trailer out in Washington. The 35-ft long, 27-ton unit provides full 13.09/7.56/-4.36/2.52-kv switching and protection from 66/55-kv transmission (p 68).

MANAGEMENT ▶ **The current cutback in capital spending is longer and deeper** than in other post-war recessions. It probably won't turn up until mid-1959, and will take several years to get back up to 1957 levels. Utilities are still bucking the trend, but some cutbacks will show up in the next two years. A bright spot is industrial research—up a full $1 billion this year despite the recession (p 111).

INDUSTRIAL ▶ **The ac network analyzer,** time-tested utility tool, is finding increasing use by industrial electrical engineers interested in conducting load flow and other studies of their plant's distribution systems. GE engineers tell when to use one, and how it works (p 88).

SELLING ▶ **Thermo-electric appliances that both cool and heat,** that are silent, vibrationless, and have no moving parts, will offer great sales possibilities in the future. They "could easily double" the $1 billion worth of appliances sold yearly, according to Westinghouse (p 116) . . . Two 100-ton electric arc furnaces boost steel production 70% over open hearth methods; require less manpower . . . Automatic, continuous arc welder applies new surfaces to bearing components (p 118).

MANUFACTURERS ▶ **Multipoint recording potentiometer** handles from 2 to 24 points by means of simple plug-in adapter units. Changeover, a screwdriver operation takes three minutes (p 96) . . . Low annual operating costs are feature of new premium transformer with substantially reduced copper and core losses (p 96) . . . Pressure relief device will be available as standard equipment on power transformers (p 102) . . . Lightning arresters are factory-installed components for distribution transformers, saving time and trouble of separate installation (p 96).

NEW EQUIPMENT ▶ **A 600-v current transformer for indoor or outdoor use** is available in double range 200/400 amp rating, and others . . . Fast, accurate testing of single phase, self-contained w-hr meters is possible with an automatic meter tester . . . Neutral mid-span clamps for open wire or triplex secondaries provide additional climbing space on poles (p 106) . . . Network transformers with spirally laced cores are smaller and have improved electrical characteristics (p 108).

PEOPLE ▶ **"The electrical industry has contributed more** to the American standard of living than any other single industry", says NEMA's new president, Joseph L. Singleton (p 58).

Middle South Utilities' newest vice president is Harold F. Sanders . . . Gerald H. Phipps steps up to executive vice president and treasurer at California Electric Power Co . . . John W. Belanger is new general manager of General Electric Co's apparatus sales division . . . Vice president-research of Union Carbide Nuclear Corp is Dr Corneille O. Strother . . . Frank H. Roby becomes executive vp, Federal Pacific Electric Co (p 120).

Where a multiplicity of rates is in force, analysis usually shows that promotion of certain optional rates is desirable. Load building can then be profitably selective with respect to rates in addition to load characteristics. And these two factors primarily determine the earnings and investment impact of all loads.—**Frederick W. Kimball, Public Utilities Fortnightly, July 3, 1958.**

TECHNICAL NOTES

Reactor control systems of the future will probably rely on temperature rather than flux indications. Automatic control systems will also be slower and consequently more reliable.

Fluctuating loads can cause relatively large frequency swings with propeller hydraulic turbines because the governors on such wheels must, for speed stability reasons, be set with a relatively large temporary speed drop.

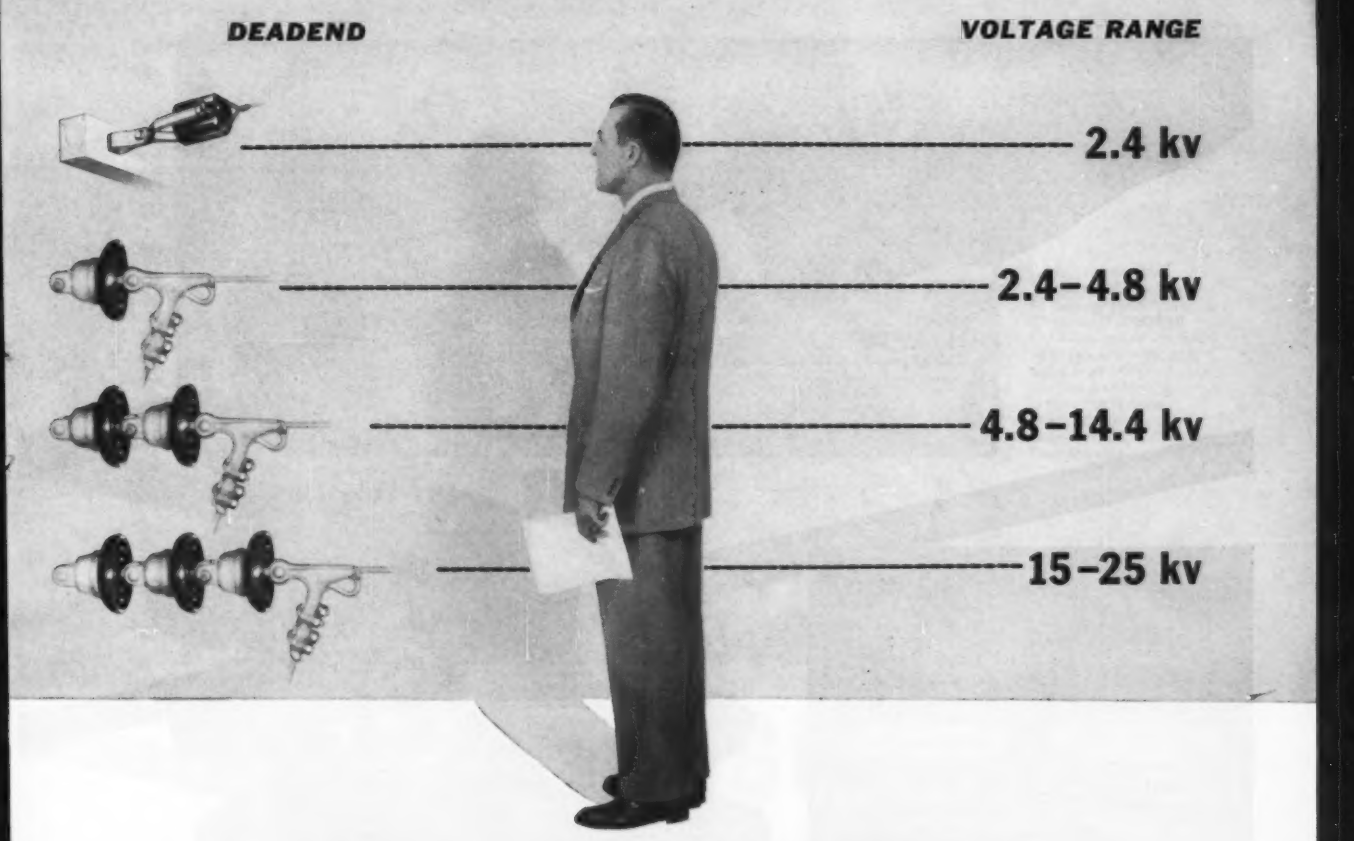
Arc-quenching properties of sulphur hexafluoride gas are due to the strong affinity for electrons exercised by the molecules of the gas. When an arc is drawn into this gas, the conducting electrons in the arc are captured by the relatively massive molecules of the gas.

Physics and practical engineering considerations limit natural uranium fueled reactors to exit gas temperatures of about 800F.

FROM EDITORS IN THE FIELD

The 550-Mw turbine generator for Great Britain's Thorpe Marsh Station will be cross-compounded but the units will be arranged in line rather than the usual side by side arrangement. Steam conditions will be 2,300 psi, 1,050F/1,050F. Generator stators will be water cooled. Shaft driven main and pilot exciters will be provided.

Spraying of stumps with herbicides within eight months after initial mechanical clearing provides a kill of 80% for Tennessee Valley Authority. To complete the control of right-of-way growth, two basal treatments are applied within the next ten years. Stump treatment costs half as much as the foliage method and is more effective.



Which Deadend Will Fit Your Distribution System Tomorrow?

BUILD IT NOW AND BE READY FOR HIGHER VOLTAGES OF THE FUTURE

Remember when all that was needed for insulating a distribution deadend was a simple x-strain insulator, a Johnny-ball? People were saying that distribution voltage couldn't possibly ever go over four kv. After all, customers weren't going to need *that many* light bulbs.

You know what's happened. They are using "that many" light bulbs, plus dozens of other "Live Better . . . Electrically" items. Voltage in the 12-kv range is almost as popular for primary distribution as two kv once was. Already, many companies are thinking about 22 kv. Some forecasters say that they may eventually settle for even higher voltages.

You probably already know how high you want to go with distribution voltage. Our only suggestion is that you take a good look and make sure it's high enough. As you rebuild deadends and build new primary distribution lines, install enough insulation to fit your ultimate plans. At strain positions it will save a lot of future labor expense, and give you assurance that the line is insulated for tomorrow's voltages.

The insulators to use? Graybar has them, and they're made by Ohio Brass.

OHIO BRASS COMPANY, MANSFIELD, OHIO

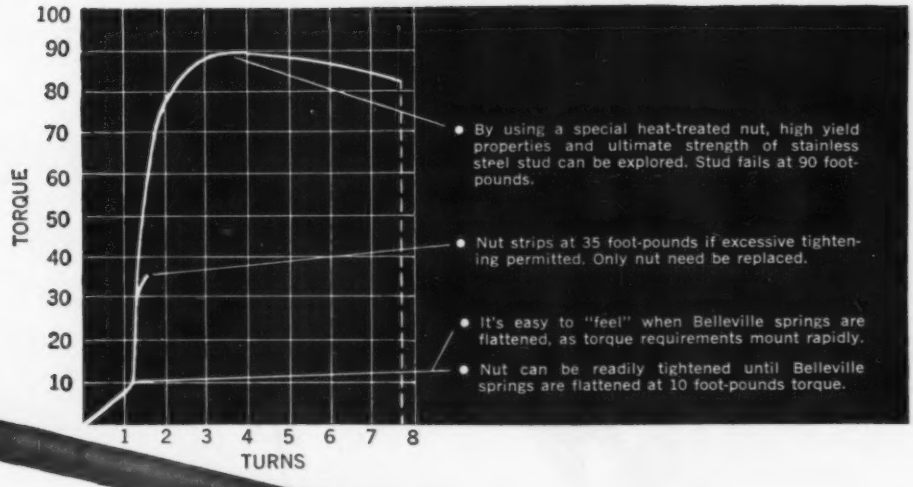
LIVE BETTER ELECTRICALLY

Ohio Brass

GRAYBAR Distributed by GRAYBAR ELECTRIC COMPANY

4867-K

With 10 foot-pounds of torque applied, the Belleville springs flatten, indicating the proper clamping pressure is applied to conductor.


100
90
80
70
60
50
40
30
20
10
TORQUE
1 2 3 4 5 6 7 8
TURNS
• By using a special heat-treated nut, high yield properties and ultimate strength of stainless steel stud can be explored. Stud fails at 90 foot-pounds.
• Nut strips at 35 foot-pounds if excessive tightening permitted. Only nut need be replaced.
• It's easy to "feel" when Belleville springs are flattened, as torque requirements mount rapidly.
• Nut can be readily tightened until Belleville springs are flattened at 10 foot-pounds torque.

Graph shows that Varex nut will strip at 35 foot-pounds of torque, far less than the 90 pounds required to break the stud. If it were possible to continue applying torque, porcelain wouldn't break until torque reached 250 foot-pounds.

It's Easy to Clamp Conductor RIGHT on VAREX Terminals

COMBINATION OF STAINLESS STEEL STUD AND BELLEVILLE SPRINGS PROVIDES 3 TO 1 SAFETY MARGIN

The graph shows just what happens as the nut is tightened on the stainless steel stud of a Varex capacitor terminal. It's easy to get the right pressure on the conductor.

As the foot-pounds of torque reach 10, the Belleville spring washers flatten . . . a visual indication that the nut is tight enough for service. At this point you can also *feel* a definite increase in torque. With the washers flat, over 1000 pounds of pressure are exerted on the conductor, more than an adequate clamping force.

Even if these signs are ignored, there's a built-in protection feature to the Varex terminal. At 35 foot-pounds, the nut strips, long before any damage could be done to the stud. It was planned that way for the simple reason that a standard nut—as used on Varex—is easier to replace than a stud.

Now assume that a special tool steel nut is used (one that won't strip) and more torque is applied. The stud would break at 90 foot-pounds—indicating that the safety-strip feature of the nut gives a safety factor of almost 3 to 1 (90 to 35). If force is again applied, the porcelain eventually breaks at 250 foot-pounds or higher.

We give you these typical values to show the graded protection that is an inherent part of the Varex terminal. True, you'll probably never need all the strength that's available in the stud and bushing. But it's reassuring to know the extra margin is there . . . another good reason for specifying "Varex" on your next capacitor order.

OHIO BRASS COMPANY • MANSFIELD, OHIO

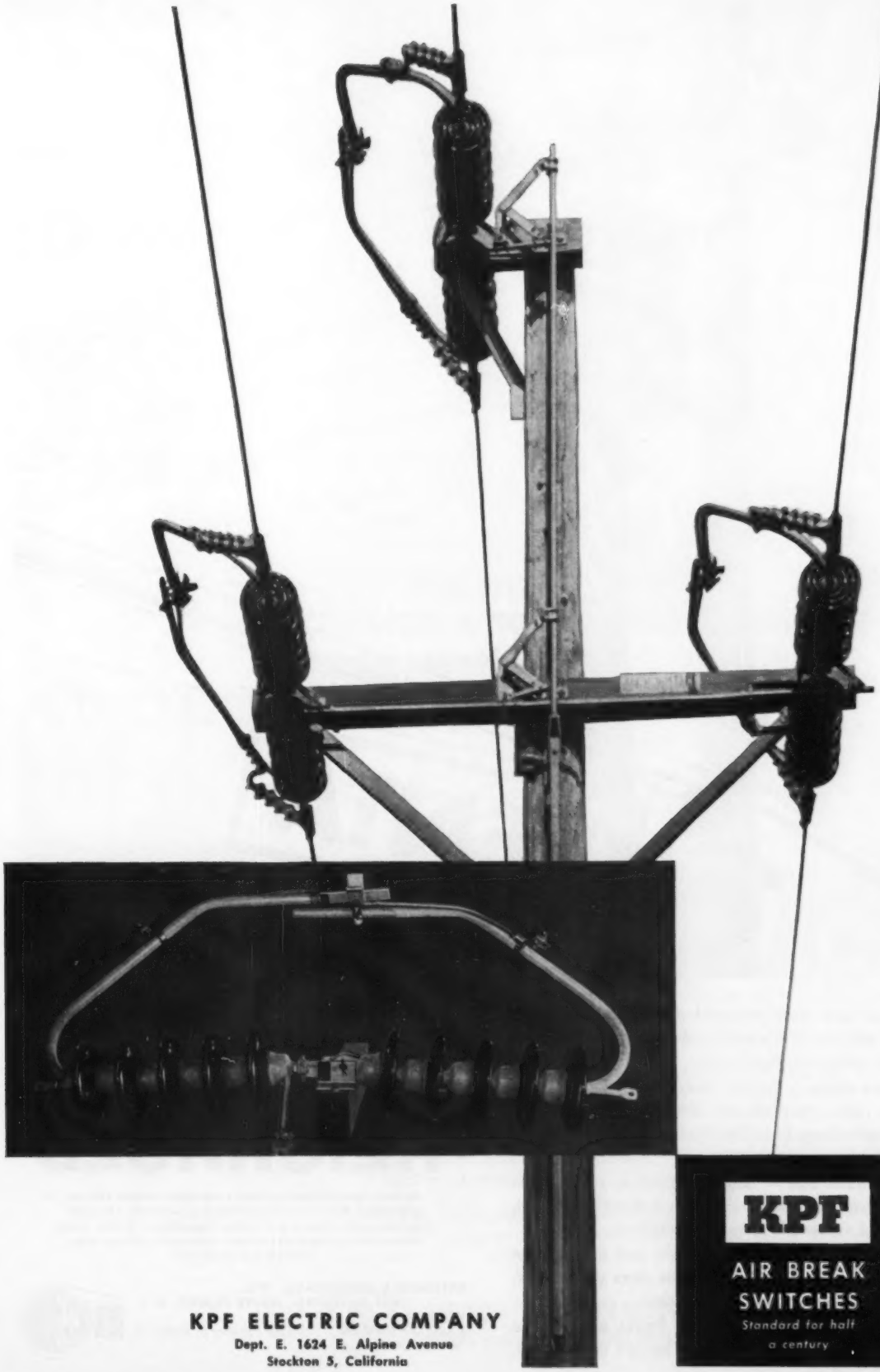
Ohio Brass

4872-H

This look on a pole means KPF

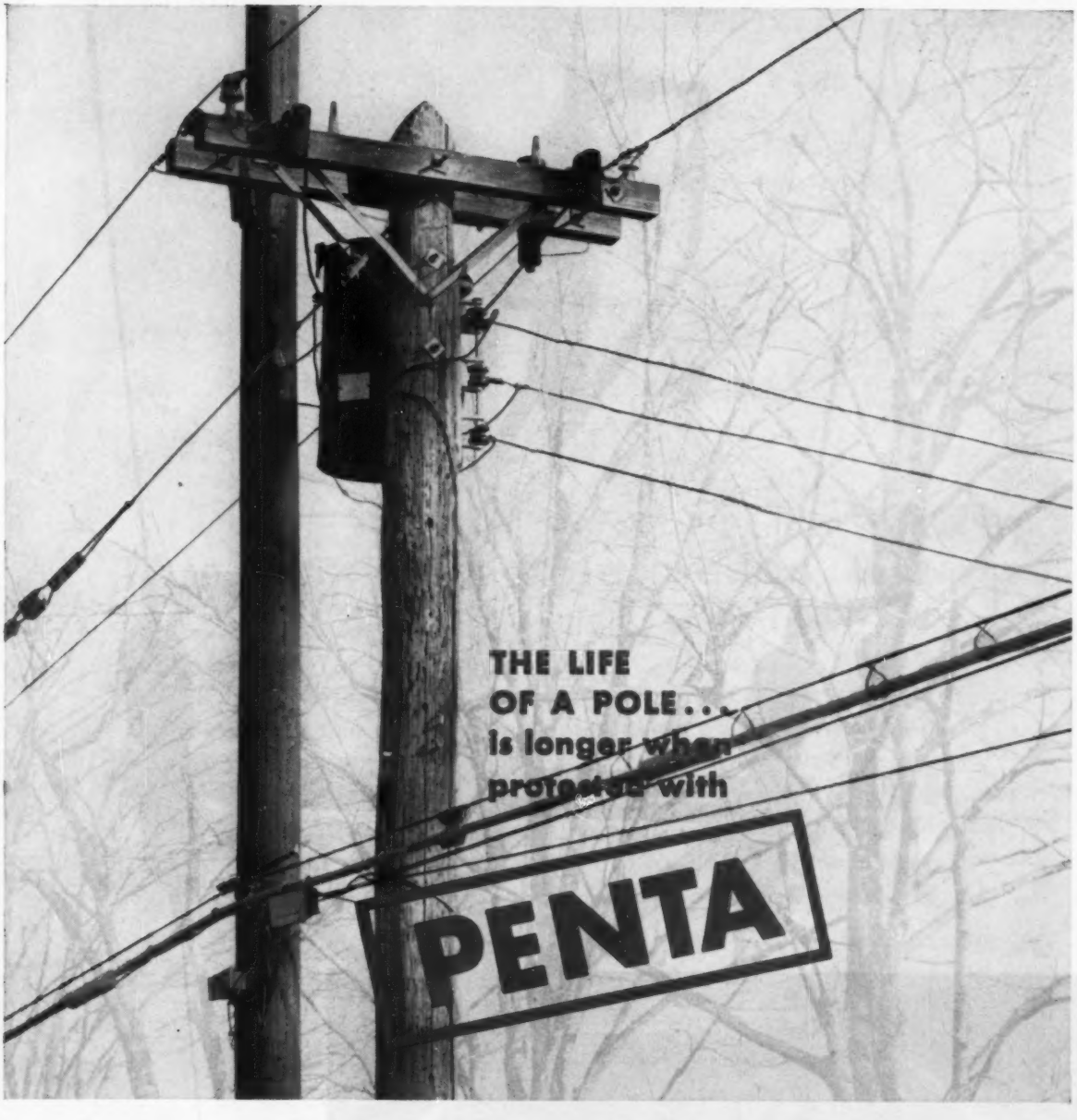
No other air break switches look like KPF, or perform like KPF. The simple, functional design of KPF switches produces a clean pole top appearance. It also insures operating dependability in all weather. There are no delicate, complex mechanisms to freeze, lock, need lubrication or wear out. The light weight of rugged KPF switches means that no extra mounting structures are required.

Lower cost KPF switches have proved their advantages in over 50 years of service on major utilities. Make a test installation this month on your own system.



KPF ELECTRIC COMPANY
Dept. E. 1624 E. Alpine Avenue
Stockton 5, California

KPF
AIR BREAK
SWITCHES
Standard for half a century



Today, more and more men with maintenance on their minds will tell you . . . it's good business to protect lumber with PENTA treatment. Here's why:

1. Costs no more — Service records show PENTA treatment gives poles, cross ties and other lumber for exposed structure extra long life. Yet PENTA treatment costs no more than ordinary preservatives.

2. Won't leach out — Because PENTA is an oil-borne rather than water-soluble preservative, it doesn't leach out, leaving wood vulnerable to rot and termites.

3. Clean to handle — Construction and maintenance supervisors know that workmen handle clean wood faster, more efficiently — and with fewer kicks!

Reichhold is a major supplier of PENTA to the wood industry and to wood users. If you haven't done so yet, investigate this modern method of protecting your lumber investments — write for the name of your nearest Reichhold distributor of PENTA.

REICHHOLD

Synthetic Resins • Chemical Colors • Industrial Adhesives • Phenol
Hydrochloric Acid • Formaldehyde • Glycerine • Phthalic Anhydride
Maleic Anhydride • Sebacic Acid • Ortho-Phenylphenol • Sodium Sulfite
Pentaerythritol • Pentachlorophenol • Sodium Pentachlorophenate
Sulfuric Acid • Methanol

REICHHOLD CHEMICALS, INC.,
RCI BUILDING, WHITE PLAINS, N.Y.

Creative Chemistry . . . . . Your Partner in Progress

RCI

NEW DIODE SPEEDS VOICES—

AT 6,000,000,000 C.P.S.

How the radio art can be improved through solid state science is illustrated by a recent development at Bell Telephone Laboratories. To make voice signals travel by microwaves they must first be "converted"—caused to vibrate at billions of cycles per second. To date, it has been possible to accomplish this conversion only at the cost of appreciable loss of signal energy. Could a more efficient converter be provided?

In the field of solid state science it was known—as a laboratory curiosity—that semiconductor diodes can be made not only to convert the frequency of signals, but also to amplify them. At Bell Laboratories Dr. Arthur Uhlir, Jr., and his associates calculated that this amplifying action could be put to practical use. They proved the point by developing a junction diode converter which can deliver up to 40 times as much signal energy as previous converters.

This efficient new converter will be applied in a new Bell System microwave highway able to transmit thousands of telephone conversations and a dozen television programs simultaneously at six billion cycles per second. In other forms it is being developed, under Signal Corps contract, for radar and military communications where more efficient frequency conversion can also be used to advantage.

This development is an example of the many different ways in which Bell Laboratories works to improve your telephone service and communications at large.

BELL TELEPHONE LABORATORIES

WORLD CENTER OF COMMUNICATIONS RESEARCH AND DEVELOPMENT

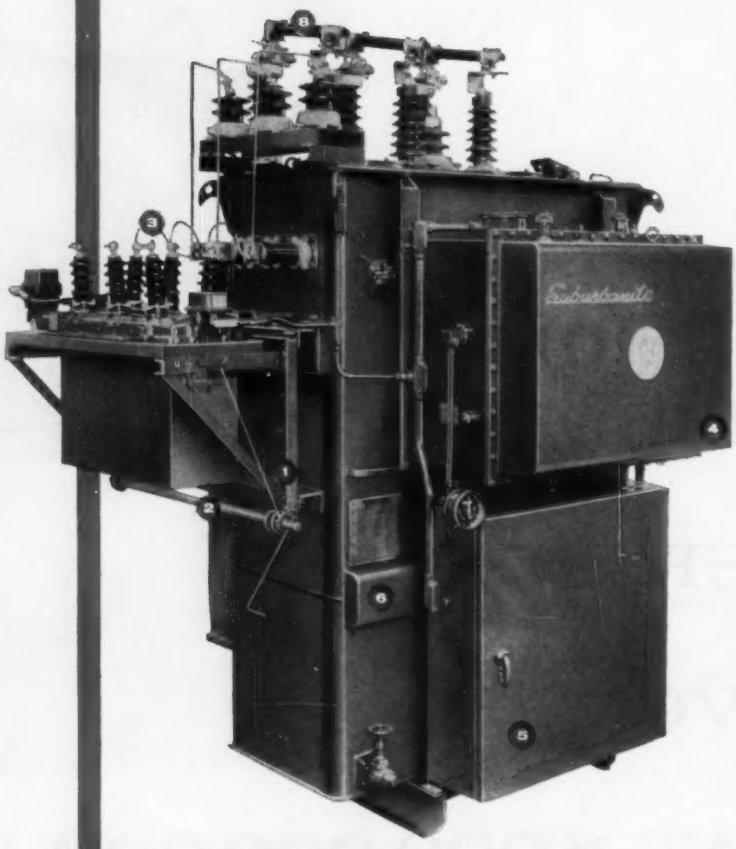
SUBURBANITE DESIGN DETAILS

External

1. Recloser framework is mounted directly to transformer. Shipped completely assembled.
2. Built-in winch simplifies inspection and maintenance of recloser. Bottom section of recloser tank, with oil, can be lowered—while top section, with contacts exposed, remains in place.
3. Flexible connectors between transformer low voltage bushings and recloser prevent strain from thermal changes or vibration.
4. Hood of LTC compartment is hinged for easy access.
5. Metering equipment is located in easy-to-reach cabinet.
6. Sealed transformer tank is reinforced to protect against positive and negative operating pressures.
7. Built-in dead-ending structure (not visible in photo) is provided on the high voltage side.
8. High voltage bushings equipped with fuses.

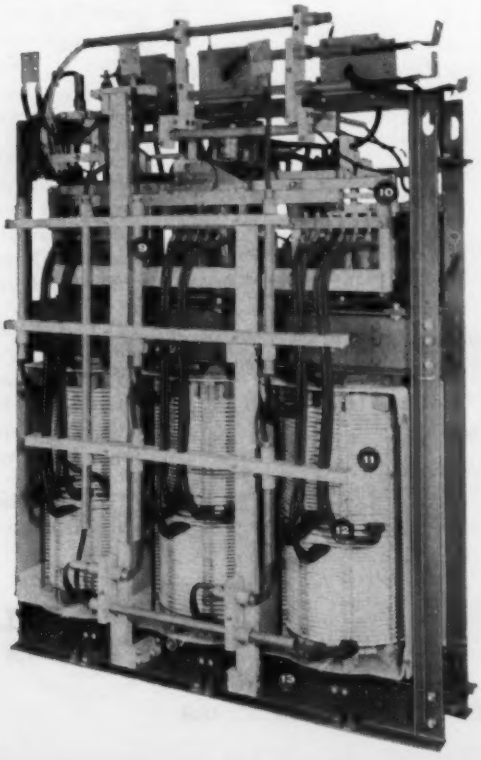
Internal

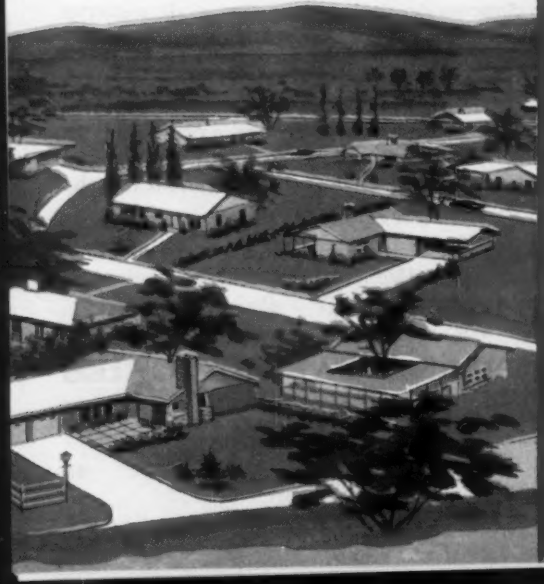
9. Leads are well supported and are insulated in heavy pressboard tubing.
10. Tap changer for de-energized operation features Pennsylvania's exclusive "straight-line" construction.
11. Pancake-type high voltage coils provide exceptional mechanical strength. Coils are precompressed to prevent distortion or displacement during short circuit.
12. Taps are arranged to assure electrical and mechanical balance and to minimize impedance variation.
13. Core-and-coil assembly is enclosed and clamped in a rugged, four-sided, structural steel frame.



PENNSYLVANIA SUBURBANITE

1000 kva, three phase, 60 cyles. High voltage: 22900Δ volts. Low voltage: 4360Y/2520 volts, with LTC equipment for ±10% regulation in 32 steps of ⅝%.





For rural areas, small towns, and outlying industrial plants...

the PENNSYLVANIA "Suburbanite"

A new, factory-assembled, low-cost, one-piece substation

SAVES 25%... CUTS INSTALLATION TIME

Pennsylvania's new Suburbanite substation — specifically designed for use in less populated areas—saves as much as 25% in initial cost, compared with other types of substations. Because the substation is factory-assembled and shipped in one piece, additional savings usually result from the simplicity and ease of installation, for which no additional steelwork is required.

FASTER INTERRUPTING TIME

The Suburbanite provides this outstanding economy without sacrificing necessary efficiency and safety. Instead of an air or oil circuit breaker, it utilizes a completely automatic recloser that is mounted in framework attached directly to the transformer. The recloser clears the low voltage line in just 2½ cycles in the event of a fault —or twice as fast as the equivalent oil circuit breaker.

FLEXIBLE IN DESIGN

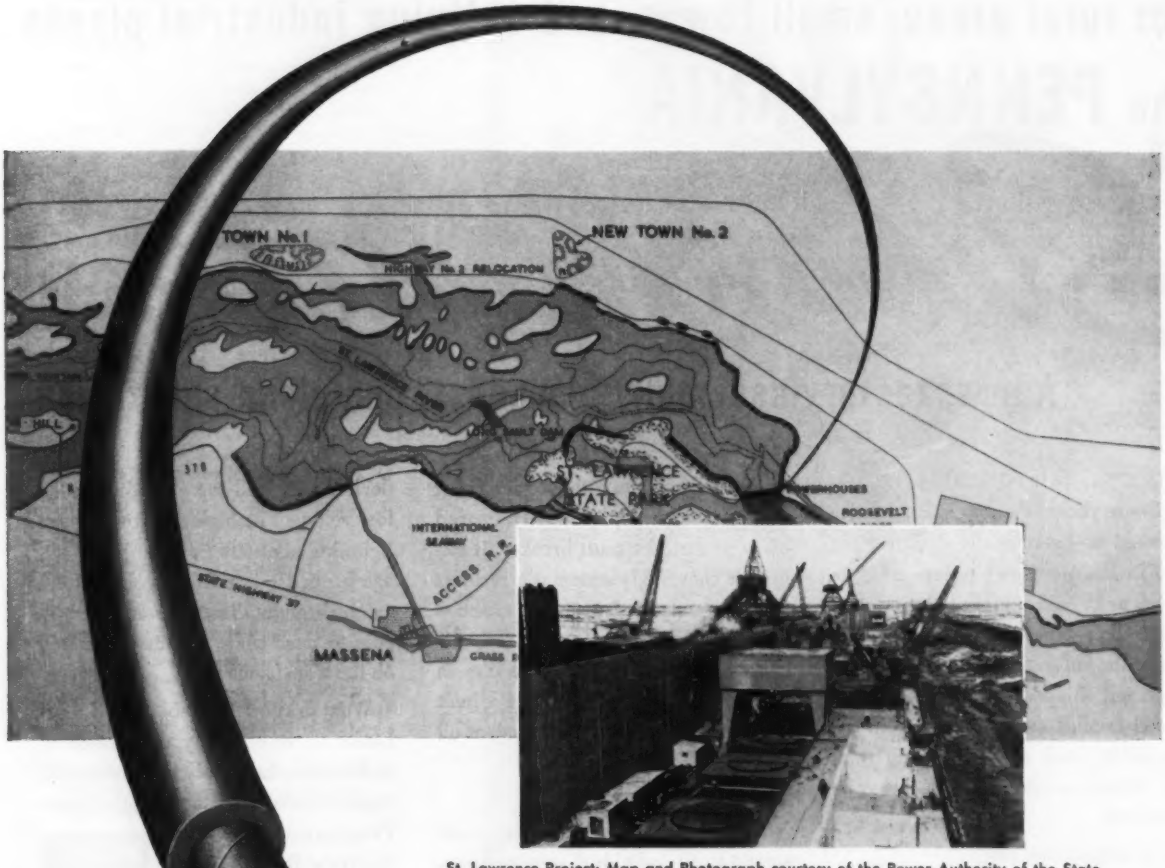
The Suburbanite can be tailor-designed to fit individual requirements. Optional equipment includes metering devices . . . load tap changing in the low voltage . . . high and low voltage lightning arresters . . . and high voltage fuses. High and low voltage lines can be brought directly from a nearby pole to dead-ending frames mounted on the transformer.

Want to know more about the Suburbanite . . . its economy and ease of installation as they apply to your specific requirements? Contact Pennsylvania Transformer Division, McGraw-Edison Company, Canonsburg, Pa.

McGRAW EDISON

PENNSYLVANIA POWER TRANSFORMERS

Another call for Collyer . . .



St. Lawrence Project: Map and Photograph courtesy of the Power Authority of the State of New York. Project Engineers: Uhl, Hall & Rich, Boston, Mass., and Massena, N. Y.

At the St. Lawrence Power Project . . . COLLYER CONTROL CABLE

Style RR with RH-RW Insulation

THE VAST ENERGY POTENTIAL of the mighty St. Lawrence River is being harnessed in a power project of tremendous proportions, a joint effort of the Power Authority of the State of New York and the Hydro-Electric Power Commission of Ontario.

This multi-million dollar project is a monument to man's imagination, engineering genius, and peaceful cooperation. Collyer is proud to have been selected to supply the control cable which is to be used in the production, regulation and distribution of the tremendous quantities of electric energy which will be produced here.

MANY OF THE CONDUIT RUNS, although encased in concrete, are subject to adverse moisture conditions. The good aging characteristics of Collyer RR Control Cable (similar to Collyer C-101) with RH-RW insulation and neoprene-jacketed conductors, and the ability of Collyer RR Control Cable to meet the high engineering standards required on this job led to its selection for this vital service.

WHEN SEVERE ENVIRONMENTAL CONDITIONS require long-life, maximum service Control Cable, more and more engineers and contractors "Call for Collyer." Let us quote on your specific requirements. Write **Collyer Insulated Wire Co., 24 Roosevelt Ave., Pawtucket, Rhode Island.**

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Power Cables • Control Cables
Switchboard Wires • Service Cables
Series Lighting Cables • Building Wires

ALLIS-CHALMERS
POWER
EQUIPMENT
DIGEST

NEW low-cost 3-phase distribution regulator alters economics of regulation

A 30% reduction in the cost of three-phase regulation is announced by Allis-Chalmers with the introduction of a new regulator in several popular ratings. This unit combines reductions of 20% in weight and 33% in size with the large cost savings.

Utilities find these savings important enough to warrant restudy of present substation commitments and re-evaluation of cost factors.

This new regulator is an outgrowth of Allis-Chalmers continuing development program. The significance of this program is best measured by the remarkable record of savings to the utility industry.

In the period between 1948 and 1958 when utility equipment costs rose anywhere from 30% to 90%, Allis-Chalmers, with this new unit, has been able to hold the rise in cost of regulation in these ratings to only 7%.

Once again three-phase regulation is available for many applications for the same price as single-phase units.

Popular Ratings

The following ratings are available: 500 and 750 kva, 8660 volts; and 500, 750 and 1000 kva, 13,200 volts.

The new unit combines the outstanding features long associated with Allis-Chalmers regulators, such as: heavy duty, "Quick-Break" tap-changing mechanism; unit construction; "Feather-Touch" control; unidirectional breather; and *Vari-Amp*.

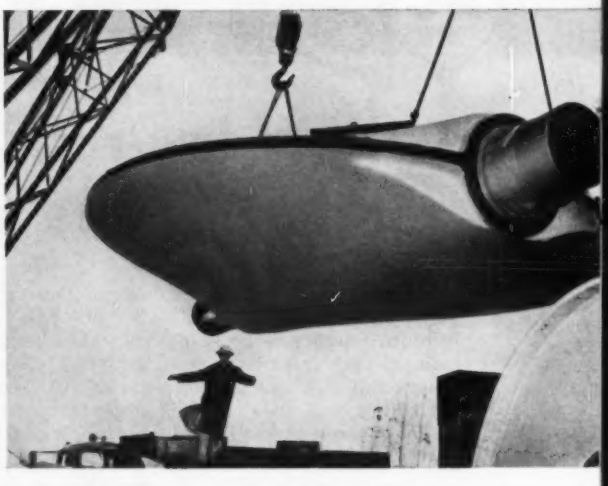
NOW...hydraulic operators for low voltage breakers from 15 to 1600 amperes

Smooth, quiet, fast-closing action is just one advantage of Allis-Chalmers hydraulic operators. This smooth action reduces stress on both operator and contact components. No adjustments are required since the closing unit is completely sealed.

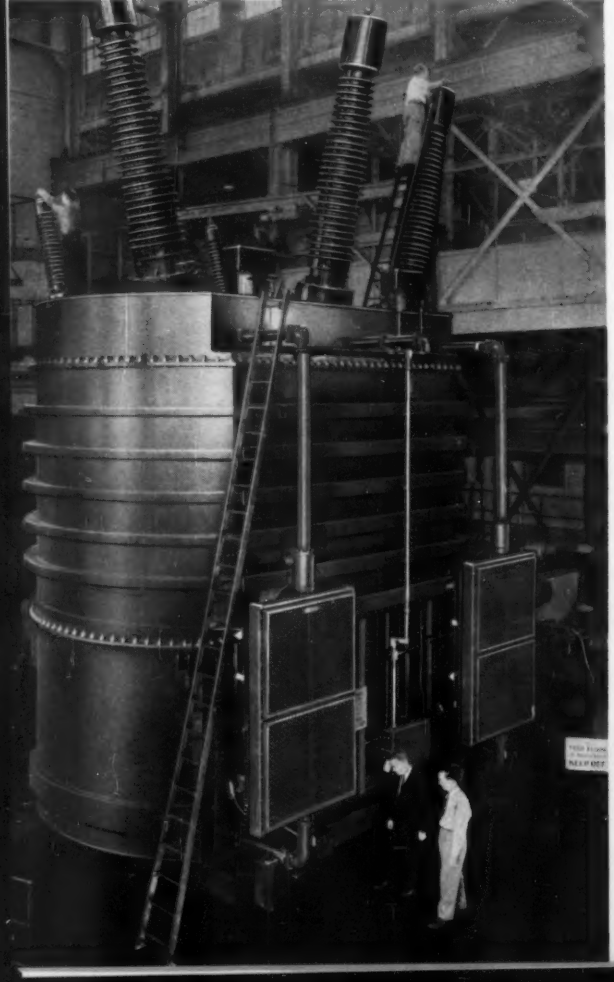
In addition, this operator unit permits closing directly from an ac power source with low control power requirements.

Valve disc and shaft

This huge 17-foot diameter, 44-ton cast steel butterfly valve disc, being lifted off truck, was built for use with a 68,000-hp, 190-ft head A-C hydraulic turbine installed in the State of Washington. Butterfly valves up to 27 feet in diameter have been built by Allis-Chalmers.



Trend seen to extra high transmission voltages



The 345-kv transformer shown here on test is another in a growing number of units in this class. Economic factors are behind this trend. At the same time as load carrying capacity of present transmission lines is beginning to be taxed—new right-of-ways are becoming more expensive and hard to get.

For some it has already become a question of either recoppering or stepping up voltage to carry the blocks of power they foresee.

A transformer for 345-kv service shown here in preparation for undergoing impulse tests on one of A-C's large impulse test floors.

ALLIS-CHALMERS

The NEW LOOK in 4.16-kv metal-clad switchgear is the low silhouette

Horizontal drawout construction, new convenience, safety and appearance are featured in recently announced Allis-Chalmers switchgear.

The new low 72-inch silhouette is the lowest in the industry and brings with it eye level instrumentation. Auxiliaries, even when placed in upper rear portion of unit, are now at shoulder height.

Complete redesign includes provision for the safest, most complete compartmentation of any switchgear. All circuits are segregated; all live parts are completely enclosed; and all metal barriers are grounded. Full interlocking further assures personnel safety.

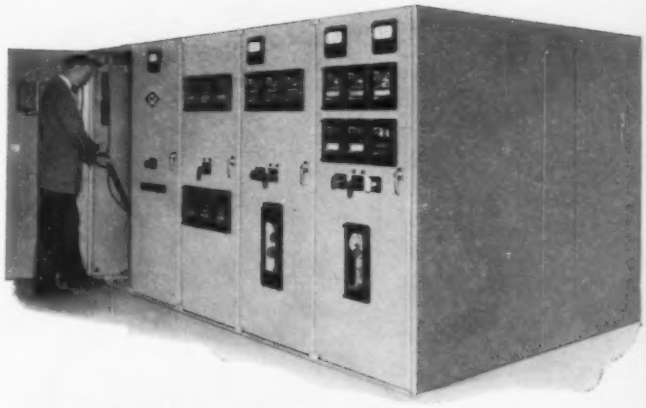
The new *Ruptair* breaker has the same design features as the larger 13.8-kv *Ruptair* breaker. Interrupting characteristics are improved to meet such needs as two-cycle operation.

A safety feature of the breaker is the hinged front metal barrier which locks firmly to the frame of the stationary structure when the breaker is in the connected position. This provides positive isolation of high voltage parts.

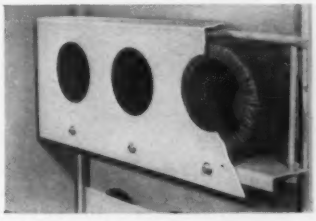
The same type mechanically trip-free four-bar linkage found on the largest Allis-Chalmers power breakers is used on *Ruptair* breakers. Quick and easy breaker disassembly is provided for contact and interrupting structure inspection.

A high level of insulation quality is maintained throughout the switchgear. All bus bar supports and primary disconnect bushings are made of high impact, high dielectric glass polyester material.

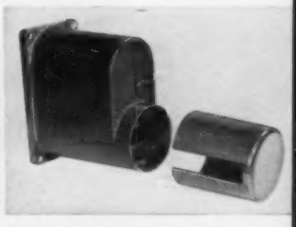
Preformed insulated joints eliminate need for molded and taped joints. This makes connecting of shipping groups at the site easier and quicker.



Man illustrates low silhouette eye level instrumentation of new switchgear.



Preformed bus joint cover simplifies field connections — eliminates taping and compounds.

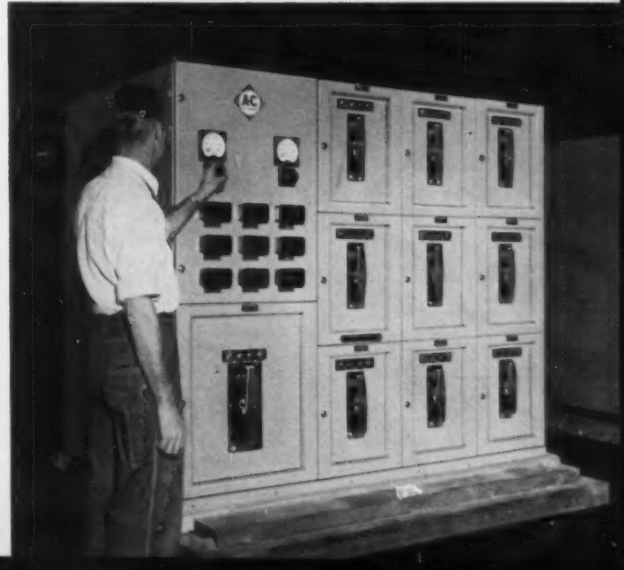


Readily accessible toroidal-type current transformers are easy to test or change.

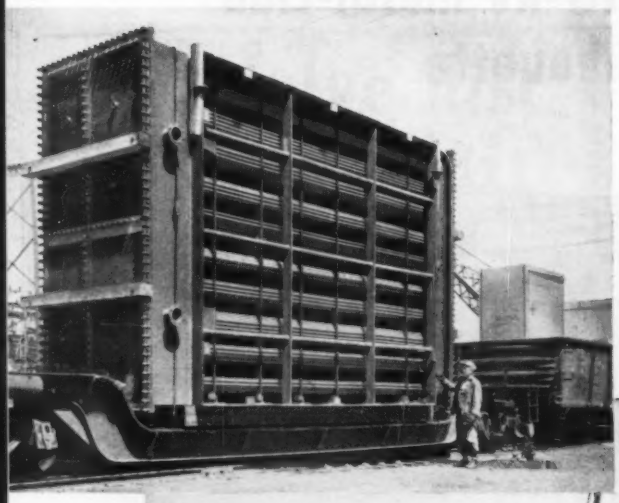
PROBLEM: low headroom
SOLUTION: low, low switchgear

Low ceilings frequently create problems of unusable plant space. Here is a typical example of how Allis-Chalmers makes use of "cramped" areas near load centers where standard height switchgear cannot be used.

This special 68-inch high Allis-Chalmers switchgear was designed for installation in the basement of a New England electrical manufacturing firm. Breakers shown are in the 600-volt class. Units of this design are available to other manufacturers with space problems.



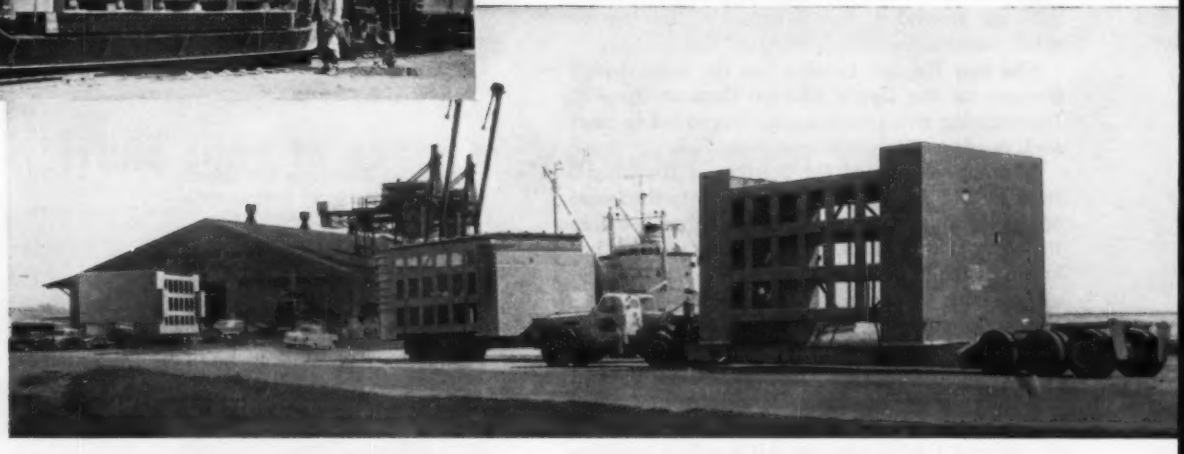
Big shipping sections mean smaller condenser installation cost



Facilities for building . . . facilities for shipping have both influenced the design of Allis-Chalmers condensers. As a result units are designed in the fewest number of pieces possible for simplified installation.

Full advantage is taken of several types of special rail cars and availability of inland port facilities. In many cases, because of these shipping facilities it is possible to ship condensers of unusually large size completely tubed.

This results in simplified field assembly and helps utilities cut installation time and cost.



Literature of interest to power men

Silco-Flex system of insulation for motor coils is described in six-page bulletin. Characteristics of the insulation are detailed. Ask for **Bulletin 05B8341A.**

New 5-kv "low silhouette" metal-clad switchgear is described in 12-page bulletin. Horizontal draw-out breaker, eye level instrumentation are illustrated. Specification sheets are also available. Ask for **Bulletin 18B8965** and/or **Specification Sheets 1857863A.**

Technical data covering new *Vari-Amp* current ratings and short-circuit ratings of Allis-Chalmers ⅝% regulators can be obtained from **Bulletin 21B9026.**

The trend to extra high voltage transformers and the background of this development are covered in a new 16-page **Bulletin 01B8771.**

Deaerator application and facts about the Allis-Chalmers line are included in **Bulletin 28B8853.**

A-5687

ALLIS-CHALMERS Milwaukee 1, Wisconsin

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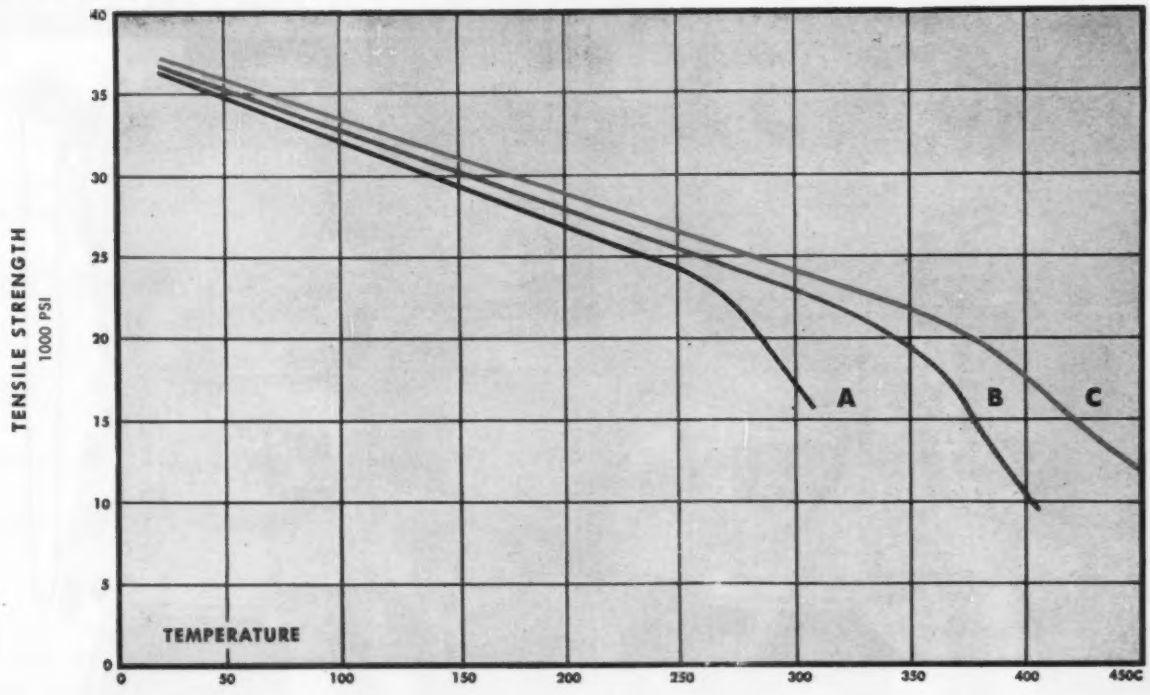
ALLIS-CHALMERS

How silver helps copper conductors at elevated temperatures



THE INFLUENCE of silver on the tensile properties of high-conductivity copper at elevated temperatures. Tests made by the Metallurgical Research Laboratory of The American Brass Company. The test pieces were copper strips, cold-rolled to a temper approximately that of hard-drawn rectangular bus bar.
A. Electrolytic copper, silver content normal
B. Electrolytic copper, silver 8.7 ounces per ton added
C. Electrolytic copper, silver 28 ounces per ton added

In heavily loaded motors and generators, the windings, collector rings, and commutators must retain their strength at the higher operating temperatures that have become the rule. And there are now many other places where copper conductors must operate at temperatures well above those heretofore considered normal.

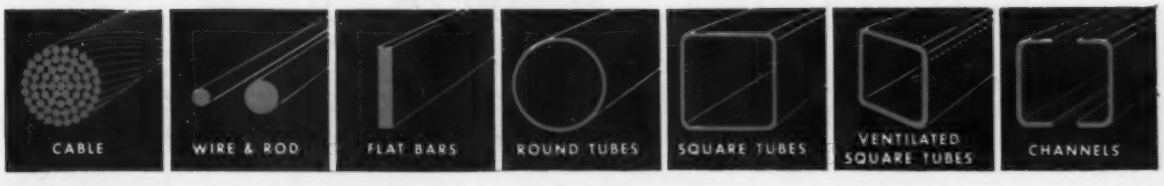
Electrolytic copper—with a very small amount of silver added—is superior to any other commercial conductor metal for use at these higher temperatures. Anaconda silver-bearing copper retains the structural design strength of the conductor at the higher operating temperatures. Annealing temperature is raised and softening delayed. The margin of safety is improved. How much gain you can count on is indicated by the chart above.

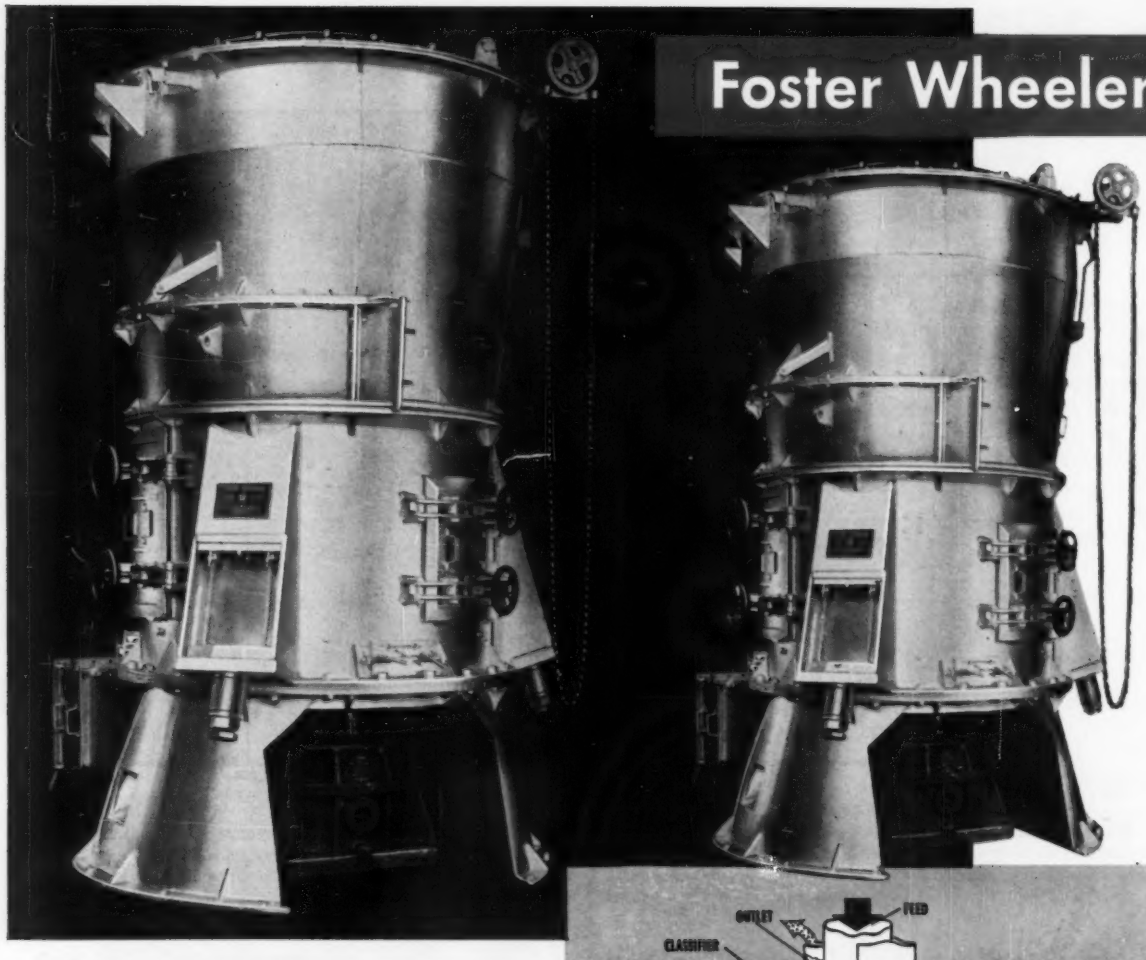
More complete information is available in the Sixth Edition of The American Brass Company's Publication C-25, "Anaconda Copper for Electrical Conductors." In addition, this 62-page booklet has convenient new tables giving physical and electrical data on all types of rigid bus conductors for the most commonly used sizes—plus a wealth of general information on the properties of copper conductors.

TECHNICAL SERVICE. The assistance of Anaconda specialists in the selection of conductors to meet your special problems is available to you. For such assistance — or to get a copy of "Anaconda Copper for Electrical Conductors" — see your nearby Anaconda representative. Or write: The American Brass Company, Waterbury 20, Conn. 58100 Rev.

ANACONDA® COPPER CONDUCTORS

THERE'S AN ANACONDA ELECTRICAL CONDUCTOR FOR EVERY NEED

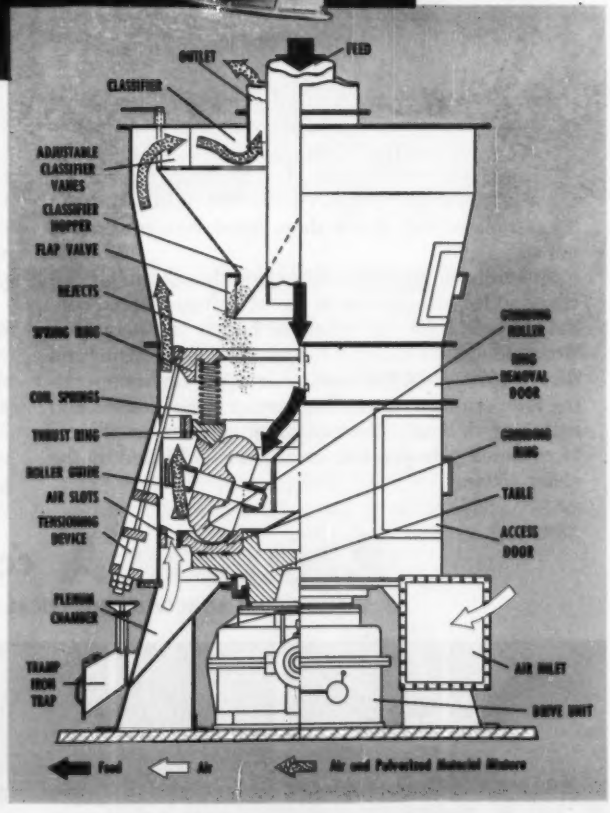




HOW THE MB PULVERIZER WORKS

In the MB Pulverizer, grinding action takes place between a slowly rotating horizontal table and three spheroidal rollers, uniformly spaced around the table and loaded by the adjustable thrust of a large number of heavy coil springs. The power driven table causes the rollers to rotate while circling planet fashion and rolling over the material on the table. The rollers move up and down independently of each other as required to compensate for foreign matter in the charge.

The charge, entering the mill, is fed directly onto the grinding table, where it is crushed between the table and the rollers. Air entering from below the pulverizer table, floats the ground particles up into the classifier, located in the top of the housing. Particles too coarse to be carried to the classifier fall back onto the table for further pulverization. The classified pulverized fuel is discharged through the outlet at the top of the casing.



"MB" PULVERIZERS

offer proved advantages of

LOW POWER CONSUMPTION and LESS MAINTENANCE

Planetary Roll and Table Design, with 9 years of successful operating experience in Europe, now available in capacities up to 60 tons per hour

THE FOSTER WHEELER Type MB Pulverizer is a simple, compact, planetary roll and table mill for pulverizing solid fuels to commercial fineness with exceptionally low power consumption, low maintenance cost and high availability.

Introduced in Europe in 1949, this type of mill has now had nine years of service experience, with excellent performance records and outstanding economy of operation. Its proved advantages, summarized below, can contribute materially to important savings in the cost of pulverized fuel for large or small steam generators.

Low Power Consumption. Efficient grinding action results in unusually low power requirements per ton of capacity, assuring lower operating costs, year after year.

Low Maintenance. Extremely rugged construction and easy accessibility of all wearing parts reduce down-time for servicing. There are no bearings or lubricated parts subject to dust and heavy pressure. Grinding ring and rollers wear *slowly* and *uniformly* and can be easily replaced when required.

Uniform Product Fineness. Throughout the life of the grinding elements, uniform product fineness is readily maintained without loss of capacity.

Pressurized or Suction Operation. With all moving parts enclosed in a stationary, air-tight casing, the MB Pulverizer can be used for either pressurized or suction operation, providing complete flexibility for various types of firing service.

High Availability. All necessary adjustments for grinding pressure and particle size can be made externally while the mill is in operation, avoiding shutdowns except for periodic inspection or overhaul.

The type MB Pulverizer, with Foster Wheeler feeders, distributors, burners and fans or exhausters, provides a highly efficient and economical pulverized fuel system, supplementing the FW line of heavy-duty Ball Mill systems. For complete information, send for Bulletin MB-58-1. *Foster Wheeler Corporation, 666 Fifth Ave., New York 19, New York.*

FOSTER WHEELER

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NEW!

T&B complete COLOR KEYED splicing package speeds line and service work

Now one new UT 5® installing tool is the *only* tool you need to make all line and service compression connections . . . including splicers, taps, and pin terminals. And T & B's color-keying insures accurate, speedy connections on a wide range of copper, aluminum and A. C. S. R. cable. Here's all you do . . . match the color of the die to the color of the connector . . . compress . . . and the joint is made.

Your T & B Distributor will be glad to demonstrate the UT 5 with its many advantages. When you use this one tool you simplify all your line and service work. For further information write for new T & B bulletin.

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IT'S THE MARK OF AN AUTHORIZED T & B DISTRIBUTOR

The complete line of T & B fittings for conductors and raceways is sold only by recognized electrical wholesalers. It's our way of assuring you the service and savings of a friendly local source. Call him for all your electrical needs. T-61

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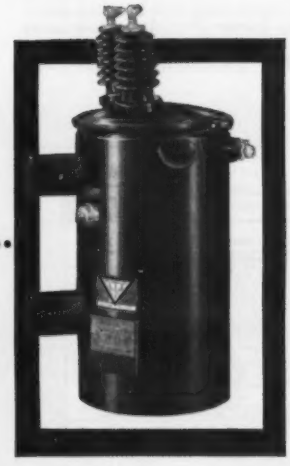
plan for the future ✳ plan to use RT&E Dual Voltage Transformers NOW!



up-rate system voltages

faster, easier, more economically

You can now look ahead and plan, with complete assurance, a relatively simple and economical way to increase system voltage. The development of the R T & E Dual Voltage Transformer makes this advance planning possible. You save on stocking, since one unit takes the place of two. You save on obsolescence when system voltage is uprated. Save on personnel needed for cut-over work.

Externally operated primary voltage change-over switch means instant voltage change, saving down time and labor time. No tank opening required, no bolted connection changes. No interruption of service; you cut over larger areas faster.

Available with all primary voltage combinations: 2400 x 4800 volts, 2400 x 7200 volts, 7200 x 14,400 volts, 4800 x 14,400 volts. Or custom designed to meet special voltage requirements. Prices for the R T & E Dual Voltage Transformer are only slightly higher than conventional single voltage transformers.

Concentrated Engineering Talent Makes One Product Better

RT&E CORPORATION

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how to coordinate SMD Power Fuses for maximum protection

a case study using a new "step-by-step" technique

A common error in fusing the primary of a power transformer is the selection of a fuse of such a speed and ampere rating that the full protection capability of the modern fuse is not put to use.

Properly selected, a modern power fuse can provide for

1. system protection,
2. transformer protection against secondary faults, even line-to-ground,
3. use of transformer short-time daily overload capability,
4. use of transformer short-time emergency overload capability, and
5. complete and precise coordination with other overcurrent devices.

The selection of the right fuse, however, has not been easy, since there has been until now no commonly and consistently agreed upon method of coordination; and only meager information about fuse performance has been available.

Consequently, a new "step-by-step" method for power fuse coordination has been developed by S&C. Supported with all necessary power fuse performance data, this method utilizes the full protection capability of the *modern* power fuse; furthermore, it lends itself to general acceptance and universal use because its development was based on the realistic recognition of

1. the duties the user desires to impose today on a power fuse, and
2. the contradictions in power fuse selection work—the need for simplicity on the one hand and the need for precision on the other.

The case study which follows illustrates the new step-by-step method. It concerns the selection, specifically, of the proper SMD Fuse Unit for application on a power transformer primary.

• • • •

Case Data:

Transformer Bank:
7500 kva, 3-phase, self-cooled.
Primary voltage: 69 kv delta
Secondary voltage: 7.2/12.47 kv wye

Short Circuit Maximum:
Primary: 750,000 kva
Secondary: 80,000 kva (bus fault)

Secondary Breaker:
Ampere Rating: 1200
Reclosing Time: 10-40-100 sec.
Relay-breaker characteristic shown by curve, Figures D and G

Procedure:

Using the S&C Data Bulletin 262, open the front cover to the step-by-step outline shown in Fig. A.

Step 1: Select voltage rating of fuse to equal or to exceed line-to-line voltage of the system—69 kv.

Step 2: Check for adequate interrupting rating (Fig. B). Since the maximum available short-circuit is 750,000 kva, the correct fuse unit is SMD-2.

Step 3: Establish the minimum ampere rating of the fuse unit. In this case use the table for self-cooled or water-cooled power transformers (Fig. C). *(Similar tables are provided for forced-air-cooled power transformers and for potential and distribution transformers.)* The fuse unit ratings in this table have been selected to carry normal short-time daily overloads of the magnitudes established by ASA in the publication, "Guide for Loading Oil-Immersed Distribution Transformers and Power Transformers." No *additional* allowance need be made. Per Fig. C under the proper voltage (69 kv) and proper kva (7500), the correct fuse unit ampere rating is 100E.

Step 4: Check coordination. Here are two ways: (1) Rule-of-Thumb Method (satisfactory in most cases) and (2) Precise Method (used when the Rule-of-Thumb Method apparently indicates that coordination is impossible).

SECONDARY FAULTS—RULE-OF-THUMB METHOD, FIGURE D.

First: Establish the fault conditions under which coordination is to be checked and compute the fault current levels. In this example, a 3-phase secondary bus fault is assumed, resulting in a primary fault current of 680 amperes (see ① in Fig. D).

Second: At this fault current level, read from the time-current characteristic curve the minimum melting time for this fuse unit, 100E amperes—Standard Speed assumed. This gives Point ② in Fig. D of 0.49 seconds.

Third: Multiply this time by .55—giving 0.27 seconds—thus establishing Point ③, the allowable minimum margin between fuse and breaker-relay curves. The factor .55 makes allowances for variations in ambient temperature and for full preloading of the fuse,

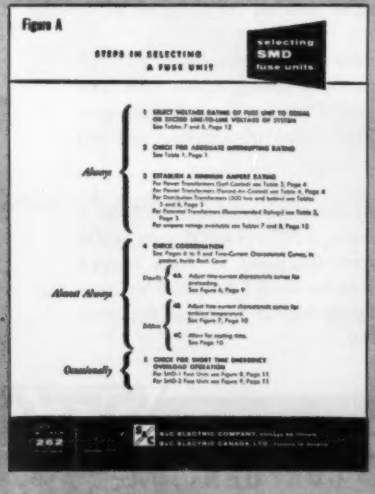
Figure A

STEPS IN SELECTING A FUSE UNIT

selecting SMD fuse units

Always

Almost Always

Occasionally

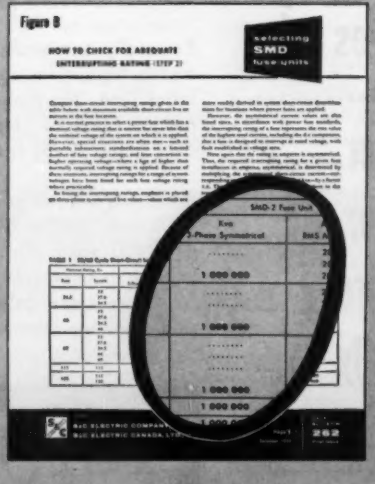
Figure B

HOW TO CHECK FOR ADEQUATE INTERRUPTING RATING

selecting SMD fuse units

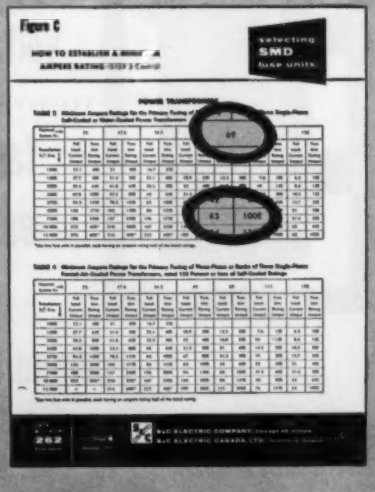
Figure C

selecting SMD fuse units

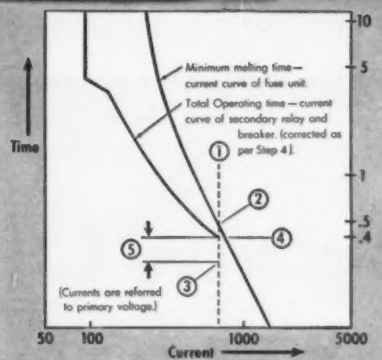

Figure D. Coordination by THE RULE-OF-THUMB METHOD—Secondary Faults

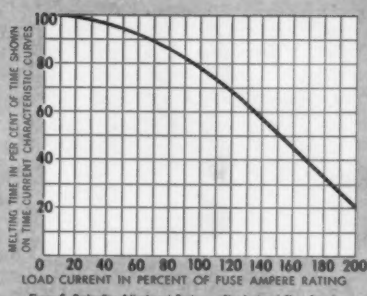
MELTING TIME IN PER CENT OF TIME SHOWN ON TIME CURRENT CHARACTERISTIC CURVES
100
80
60
40
20
0 20 40 60 80 100 120 140 160 180 200
LOAD CURRENT IN PERCENT OF FUSE AMPERE RATING

Figure E. Preloading Adjustment Factors—Standard and Slow Speeds

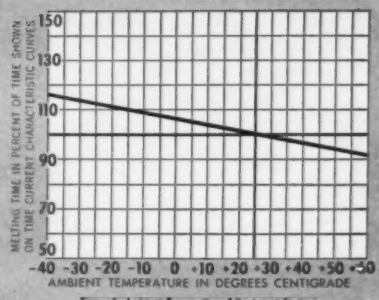

Figure F. Ambient Temperature Adjustment Factors

even from daily overloading of the transformer bank.

Fourth: Read from total operating time-current characteristic curve of secondary relay-and-breaker the operating time, Point ④, for this current level—0.40 seconds.

Conclusion: Coordination is not obtained since the time of Point ④ exceeds that of Point ③ by the amount shown at Point ⑤.

The next step is to recheck coordination, assuming a *Slow Speed* 100E ampere fuse unit. Here again, using the Rule-of-Thumb Method, coordination is not obtained. At this point, rather than to select a higher ampere rating which would sacrifice transformer protection, recheck coordination by the Precise Method.

SECONDARY FAULTS—PRECISE METHOD (an alternate to the Rule-of-Thumb Method), FIGURE G.

This method involves a comparison of the time-current characteristic curves of the selected fuse unit and the secondary breaker-and-relay *after both curves have been corrected* for the various factors that affect coordination. (See Fig. G below.) Factors for correcting relay and breaker curves are obtained from relay and breaker manufacturers.

The factors which apply to the fuse units are discussed below. They are:

- Adjustment for Preloading (see Fig. E above)
- Adjustment for Ambient Temperature (see Fig. F above)
- Allowance for the effect of cumulative heating and cooling of the fuse element during successive breaker operations (heating while short-circuit current flows, then cooling between breaker operations). Where the open-circuit time interval is less than ½ second, no allowance for cooling of the element is necessary; where the interval is 2 seconds or more (as it is in this case), the element will cool to a degree where cumulative heating need not be considered. (For intervals between ½ and 2 seconds, the full details on cooling time allowances are found in Data Bulletin 262.)

In this particular fusing problem, coordination with the secondary breaker-and-relay has been obtained by the Precise Method, since, in Fig. G, the time ② on the corrected fuse curve is greater than the total relay-breaker time ③ for this current level. This difference is indicated by ④. Were this not the case, using a Standard Speed Fuse unit, then a recheck would be made, using a fuse unit of the same ampere rating but Slow Speed. Do this rather than going to a higher ampere rating, since a higher rated fuse unit offers less protection to the transformer. If the Slow Speed does not coordinate satisfactorily, *then* recheck, using the next higher ampere rating in the Standard Speed.

PRIMARY FAULTS, FIGURE H.

For both Rule-of-Thumb and Precise Coordination Methods the same practice is used. No adjustments or margins are required. Coordination at fault level ① will be obtained where the total clearing time of the fuse unit ③ is equal to or less than the tripping time ② of the line breaker relay. ④ Indicates margin.

Step 5: Check for Short-Time Emergency Overload Operation.

These curves (Fig. I) show the ability of an SMD Fuse Unit to carry emergency overloads after carrying rated load. This overload situation arises, for example, when one transformer on a duplex substation is out of service for repairs or maintenance, putting the entire load on the other transformer and its fuses. The curves are based on an ambient of 30°C and represent the maximum *nonrepetitive* overload (in per cent of ampere rating) that an SMD Fuse Unit can carry for a given time without impairing its ability to perform properly. For each degree above or below 30°C, the capability may be adjusted 0.3 per cent.

• • • •

The above case study is a brief summary of a fusing problem solved by using the complete 12-page Data Bulletin 262 entitled, "Selecting SMD Fuse Units," published by S&C Electric Company. This bulletin with 8 Time-Current Characteristic Curves and a comprehensive text on coordination is yours for the asking.

S&C Electric Company, 4421 Ravenswood Avenue, Chicago 40, Ill. In Canada: S&C Electric Canada, Ltd., 8 Vansco Road, Toronto 14, Ontario.

S&C ELECTRIC COMPANY

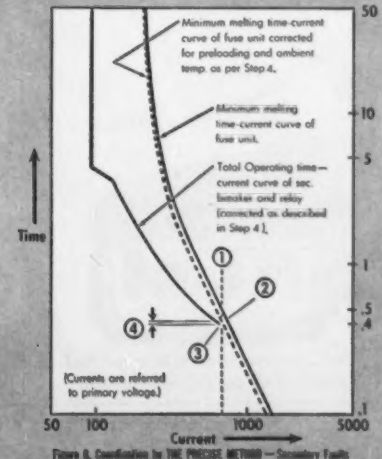

Figure G. Coordination by THE PRECISE METHOD—Secondary Faults

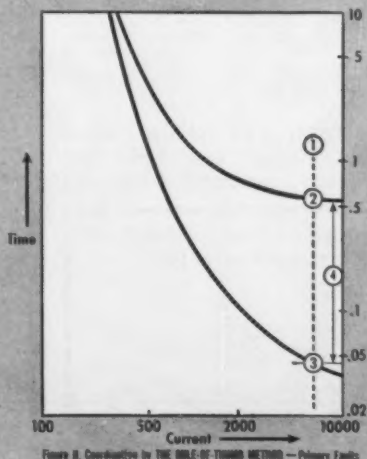

Figure H. Coordination by THE RULE-OF-THUMB METHOD—Primary Faults

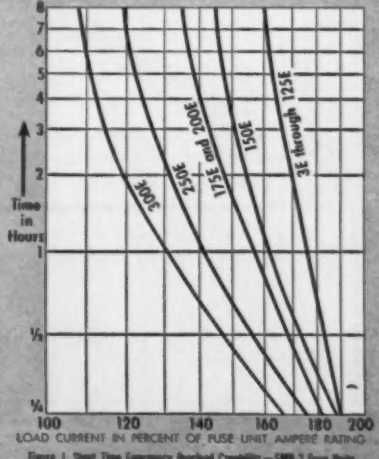

Figure I. Short Time Emergency Overload Capability—SMD-2 Fuse Units

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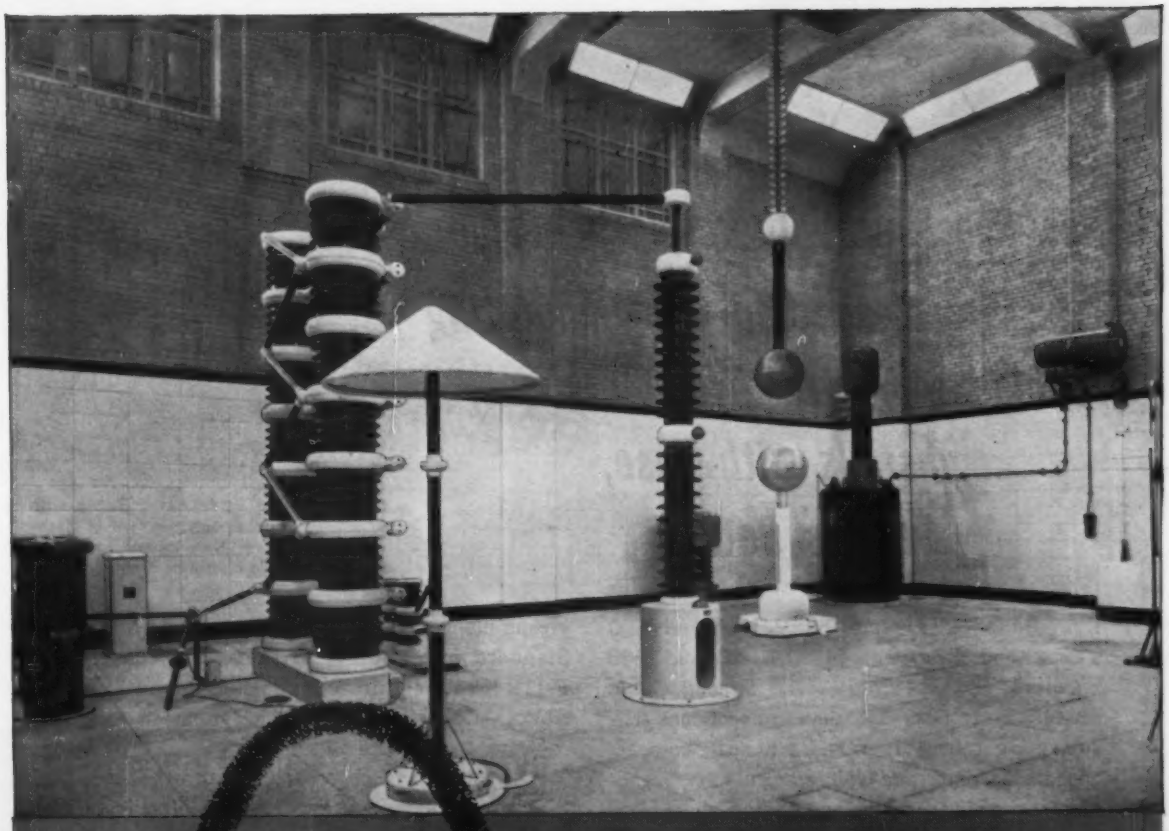

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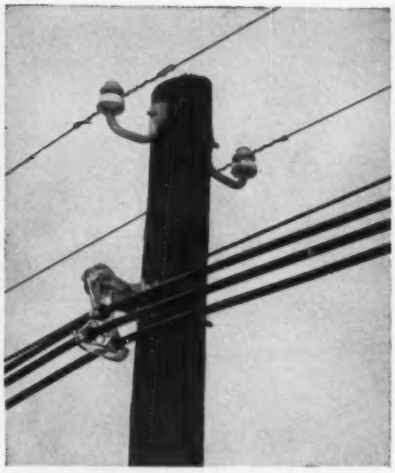

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Note how easily conductors drop into place. Installation is measured in seconds, even with "boxing gloves" on. ROECLAMP is Plexiglas†, tests to over 1000-lb. breaking strength, offers outstanding weather resistance, best possible electrical properties.

35 ROECLAMPS are required every 1000 feet. Installation is completed by hand-tightening of nut. Not even a screw driver is required!

*Pat. pending
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Report from Wisconsin Electric Power Company

HOW THE ONLY OIL WITH LIFE-OF-TURBINE GUARANTEE IS DOING AFTER 27 YEARS

Situation: On February 23, 1931, Wisconsin Electric Power started Turbine 12 at its Lakeside Station – a 7,700 kw. General Electric. The 550-gallon turbine oil reservoir was filled with NONPAREIL. A Standard Oil lubrication engineer was there to supervise the fill. After 30 days a framed certificate was furnished the utility. This certificate guaranteed that the NONPAREIL Turbine Oil would never exceed a level of acidity of 0.15 mg. KOH/g. for the life of the turbine.

What has happened: Analyses of oil samples have been made at regular intervals since the start-up date. The acidity level of the oil now is the same as the day it went into service –0.06 mg. of KOH per gram of oil. In the 27 years since NONPAREIL Turbine Oil was installed, Wisconsin Electric Power has added steadily to its generating capacity. NONPAREIL Turbine Oil has been installed in all turbines.

What to do: Get more information about NONPAREIL from your nearby Standard Oil industrial lubrication specialist in any of the 15 Midwest and Rocky Mountain states. Or write **Standard Oil Company, 910 South Michigan Avenue, Chicago 80, Illinois.**

Standard Oil's Robert A. Guis and Lakeside Station superintendent, C. E. Thielman, inspect records of Turbine 12, which has been operating with NONPAREIL Turbine Oil for 27 years. Years of experience providing technical service and an engineering degree qualify Bob Guis for work with utilities on turbine lubrication. Bob has an engineering degree from the University of Wisconsin plus 18 years of this kind of work behind him. In addition, he has completed the Standard Oil Sales Engineering School.

Quick facts about

NONPAREIL Turbine Oil

- Will not permit formation of harmful acids
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- Will maintain good demulsibility or water separating characteristics
- Has high resistance to foaming
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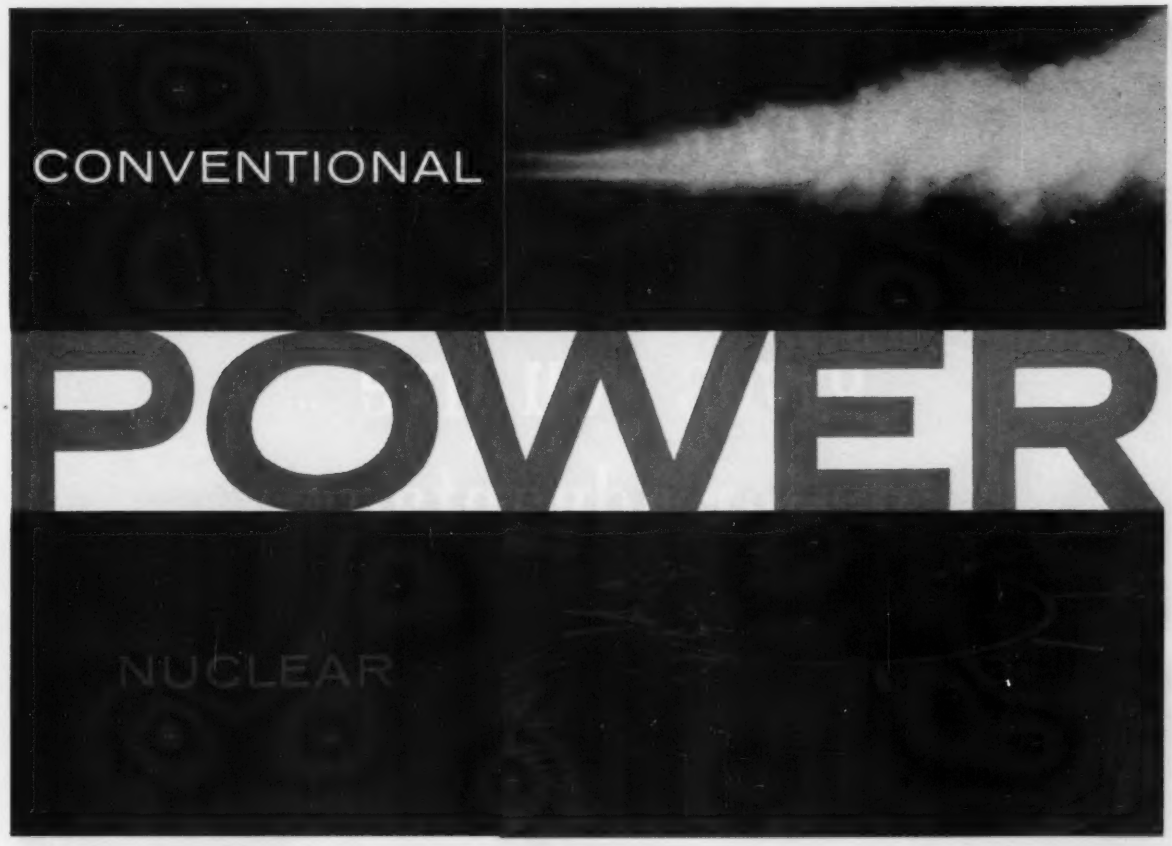
You can look up to Preformed
Made in accordance with or for use under U.S. Patent Nos. 2,609,653; 2,275,019; 2,587,521; and 2,691,685. Other patents pending.



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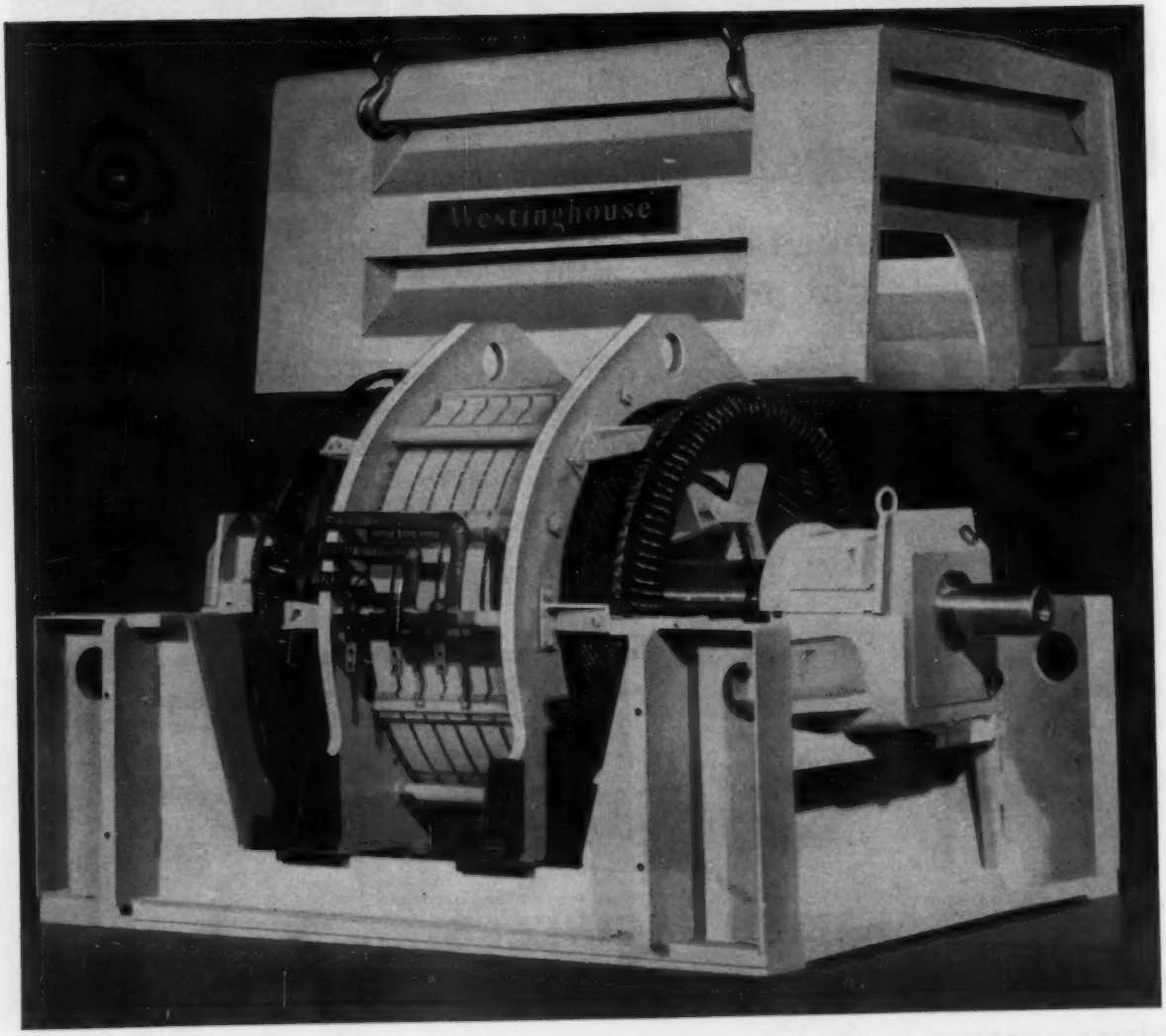
Revolutionary new Westinghouse F/A Motor gives you five major advantages



First fully accessible motor ... takes guesswork out of inspection

For the first time in large motor history, the motor housing is completely separate from the stator, with all the benefits such construction implies.

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2. Inherently quiet. Housing is isolated from the stator, reducing transmission of vibration and noise.
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4. The same basic components — rotor, stator, bearings — which have made Westinghouse motors famous for long, efficient service life.
5. Easy to connect. No conduit box. Cables pass through the base bottom with extra-ample room to connect motor leads.

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For full information, call your Westinghouse representative, or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Penna.

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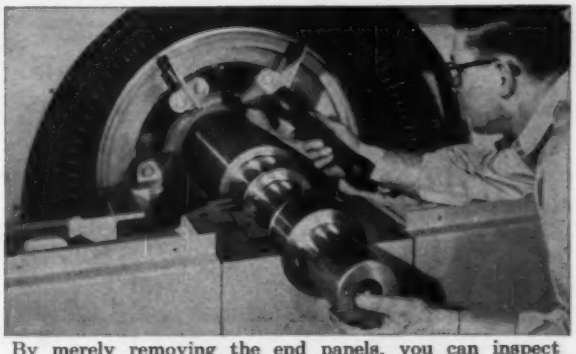
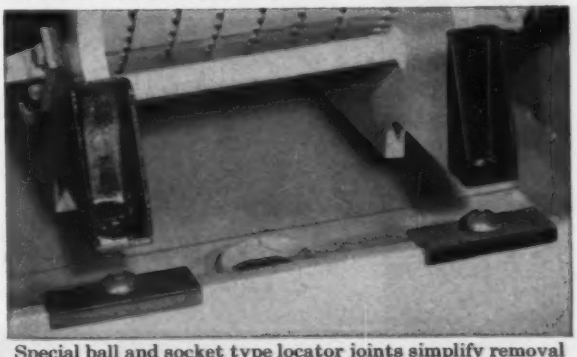


By merely removing the end panels, you can inspect windings and bearings.

Remove bearing cap, top bearing shell and oil ring; then the bottom bearing shell rolls out for easy inspection.



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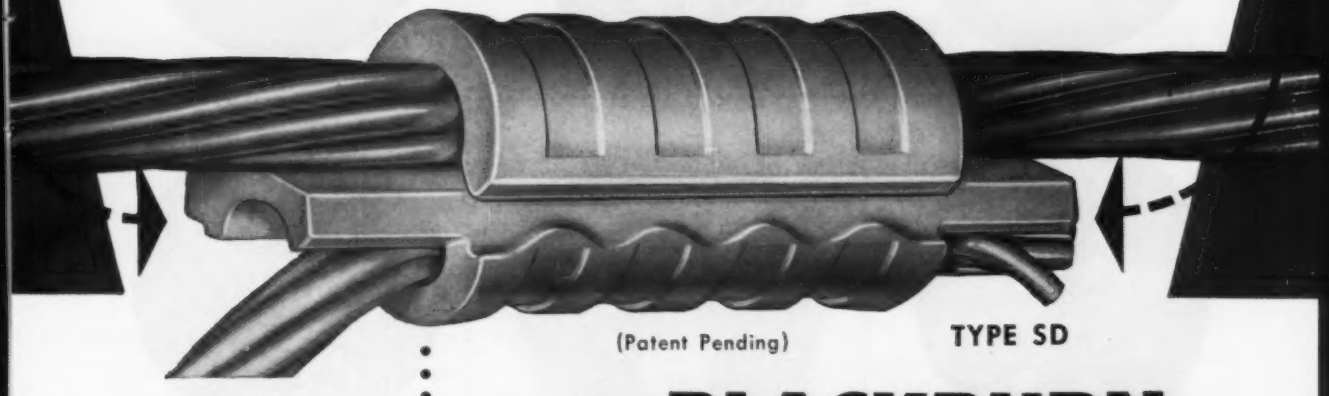


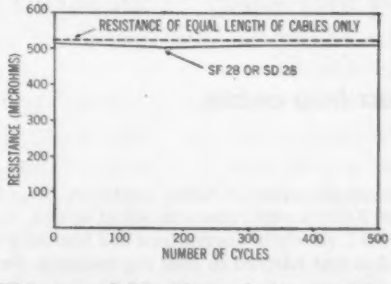
(Patent Pending)

TYPE SD

in BLACKBURN 6-Frame Tap Connector

- **Assures Separation of Conductors**
- **Provides Needed *Extra* Protection on Bi-Metallic Connections**

CURRENT CYCLING TEST TELLS THE STORY



Current Cycling Test Conditions:

1. Cables: 4 Stranded Copper; 2 ACSR.
2. Cable operating temperature: 125° C.
3. Cycle: 2 hours "On", 1 hour "Off".
4. Length of connection: 24 inches.
5. Resistance of equivalent length of wire: 522 microhms.
6. Cables were wire-brushed, but no protective compound was used.
7. Curves represent an average of seven tests.

This rugged Blackburn design provides protection for conductors from both galvanic corrosion and physical damage. The Blackburn Drip-Guard Separator, plus the completely enclosed tap, prevents corrosion products from bridging the gap between the copper and aluminum conductors. Copper wire now can be used as main or tap without corrosion damage to the aluminum conductor.

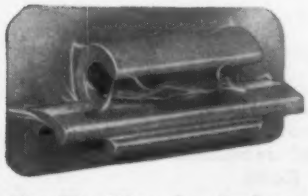
In addition, the superior Blackburn design, which incorporates external channels parallel to the tap hole, assures uniform encirclement of both conductors when compressed.

Shot-blasted surfaces protected by an oxide-inhibiting film insure oxide-free connectors at jobsite.

Type SF Recommended for Aluminum to Aluminum

This Blackburn 6-Frame Tap Connector assures complete separation and protection of the conductors. The Drip-Guard is unnecessary for this application.

Both Designs Available *Pre-Filled*



Type SD or SF may be ordered pre-filled with Blackburn's superior oxide-inhibiting compound, Contax. Pre-filling eliminates the possibility of an installation being completed without inhibitor.

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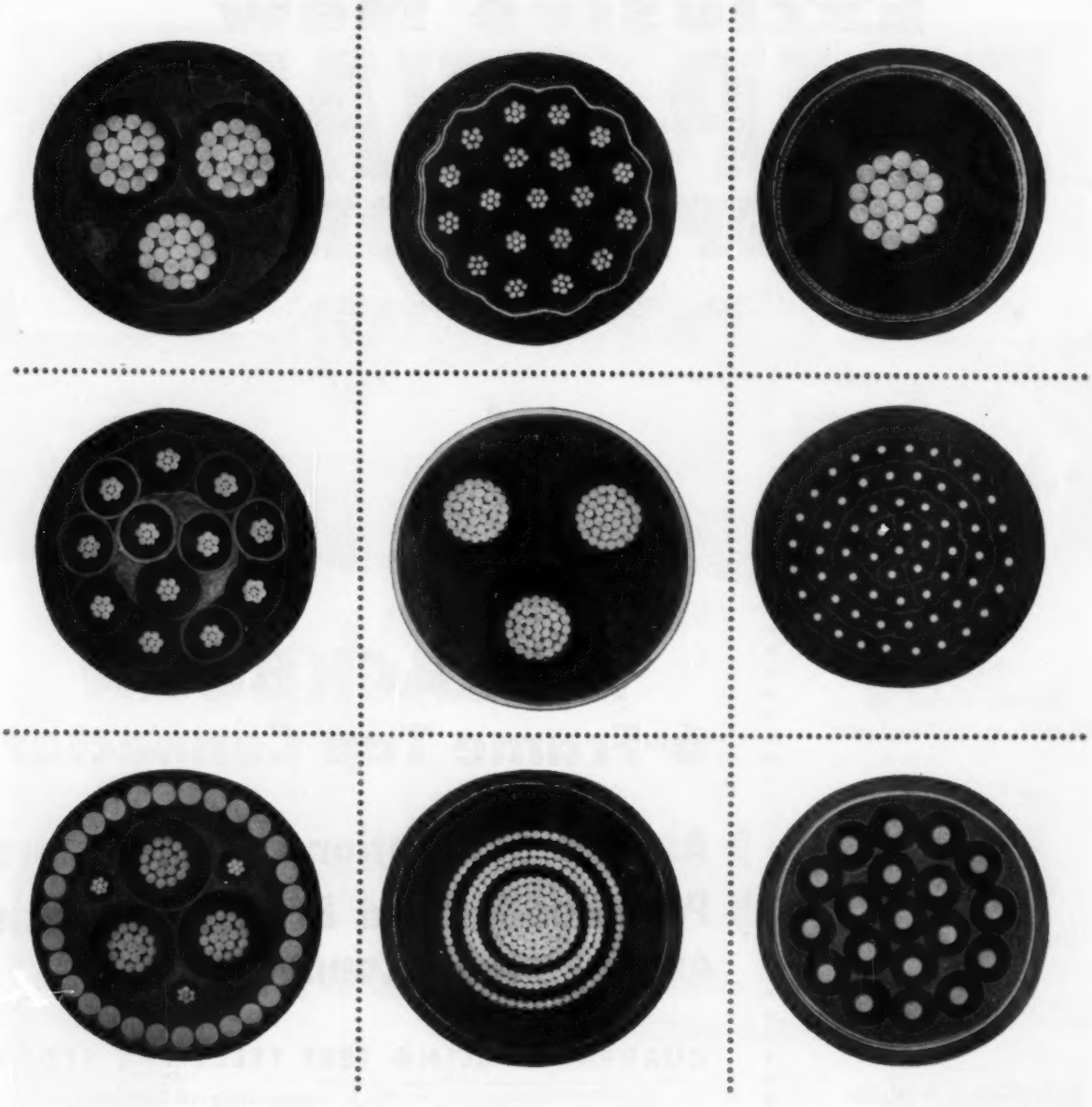

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July 21, 1958

Business Upturn for Power

The bottom of the recession has passed and an upturn in business is just ahead. So we hear from all sides. In fact, there are many indications that this view is correct. Industrial production has improved slightly and along with this are gains in employment in industry. Home and highway construction are in a healthy condition. But industrial construction lags last year's by a wide margin. These and other statistics give no real proof of an imminent upturn. We do, however, accept the general belief that business has turned the corner.

Our forecasts for 1958 as a whole now indicate that industrial production and other elements of business will be much stronger by the last quarter. But our main concern here is how this will affect the electrical industry.

Sales of electrical energy seems to be crossing over from the minus to the plus side of the ledger. For the year 1958 residential sales should be up about 9% and commercial a substantial 6%. Industrial sales on the other hand will turn in a poor performance of a minus 5% We expect an overall gain of a bare 1% for the year.

The growth in residential and commercial sales means that revenue and return from this business will be very healthy. Reports indicate that revenue from industrial business has not declined substantially because of the effects of demand charges. Rate increases have helped all three segments of business.

From these factors we would conclude that utilities might well take another look at their capital expenditures. The recession has not changed the overall outlook for growth. It has merely shifted the trend curve back about one half year's growth. That half year is over now and next year will most likely be a good one for growth in energy sales. A 10% decrease in industrial kilowatt hour sales today can easily be turned into a 5% increase one year from today. The matter of peak loads is of even more significance. For the year 1958 we expect a substantial increase in summer and winter peak loads. We now predict a growth of seven million kilowatts in the December peak load.

Therefore the time seems ripe for a return to normal and orderly construction programs and the corresponding purchasing procedures. Now is also the time to use work forces most advantageously to take care of needed maintenance while some construction may be awaiting the business upturn.

And looking a little further ahead, if 1960 corresponds to predictions and provides a gross national product 10% above 1957's, we do not have long to wait. We suggest that the industry set its sights on a business upturn for power in the months immediately ahead.

How the Atom Figures in U.S. Power

By 1980 nuclear plants will provide 21% of total generation at a cost close to 6 mills in large plants, says National Planning Association

An accelerated effort by both the federal government and private enterprise is essential if atomic energy is to supply even a fifth of the nation's electric power needs in 1980.

This is the major conclusion, conservative compared with some of the predictions made by the Atomic Energy Commission, which is reached in a new study by the National Planning Association.

Entitled "Nuclear Energy and the U. S. Fuel Economy, 1955-1980," the NPA report is bound to be widely quoted by both sides in the battle over whether the government should do more to speed development of competitive nuclear power in the U. S. For example:

- The study says drastic cost-cutting is necessary before atomic power can compete. Thus, the study can be interpreted to show the need for a "crash" government program.
- On the other hand, the report forecasts that fossil fuels will be plentiful and "cheap" for years. Thus, it may be used to underline the queston: "What's the rush about atomic energy?"

The study was conducted by an expert staff under the guidance of NPA's 17-man committee on productive uses of nuclear energy. This group, with financial backing from the Ford Foundation, has issued nine separate reports since 1954 on the prospective impact of atomic energy—particularly in other countries.

Affect on Fossil Fuels Projected

The new NPA report is the most ambitious effort to project how nuclear energy and conventional fuels will affect one another's market—and what will happen to the U. S. economy in the process.

Many of the NPA's conclusions track pretty well with previous findings.

For example, the investigators expect the nation's total energy demands—electric and non-electric—to double by 1980. Electric consumption alone is seen tripling in the same period.

NPA's experts see atomic power becoming competitive in high-cost areas of the U. S. around 1970 or 1972. And between 1975 and 1980, they expect three-fourths of all new power plants to be nuclear.

At the end of the next 25 years, they believe, nuclear power plants will account for 29% of all thermal generation, and 21% of total generation of all types.

The NPA investigators foresee atomic energy providing 24% of all maritime propulsion, and 10% of the locomotion for our railroads, by 1980.

Impact in Boiler Fuel Market

But the report states that the first, and major, impact of nuclear energy will be in the boiler fuel market—in competition with coal, oil and natural gas.

The NPA does its best to shake the complacency of those who expect ever-increasing costs for conventional fuels to usher in the day of competitive atomic power.

Many in the atomic industry have assumed supplies of fossil fuels—particulary oil and natural gas—will become more and more scarce, and consequently more expensive.

NPA's experts counter with this prediction: Coal and fuel oil prices will undergo only "moderate" price increases of 15 to 25% in the next quarter century, and supplies are plentiful. Consequently, atomic power costs must be cut dramatically to become competitive.

The report backs up this report as follows:

- Government data indicates that U. S. coal reserves total 943-billion tons, one-fourth of it recoverable at present prices. Present consumption is only a half-billion tons annually. The NPA panel sees no reason to expect major coal price increases.
- The petroleum industry estimates its "proved reserves" at some 35-billion barrels—or a 13-year supply. But another 184-billion barrels already has been discovered which could be produced at a higher price or with more economic recovery methods.

In addition, oil shale reserves have been estimated conservatively at 900-billion barrels, of which 45-billion could be produced near present prices with known techniques.

In the face of this synthetic oil potential and availabality of increasing supplies of "cheap" foreign oil, NPA concludes that a major jump in oil prices is ruled out.

Natural gas, also expected to be plentiful well past 1980, will rise rapidly in price—but only until it "catches up" with fuel oil and coal.

The joker, of course, is that oil and coal prices increase with distance from the source, with the result that the picture isn't so rosy when viewed from energy-short regions like New England.

Hence the competitive entry of the atom.

5.9-Mill A-Power Seen By 1980

Drawing from previous estimates by other atomic experts, the NPA expects the cost of power from large atomic plants to decline from 11.9 mills per kwhr in 1965 to 5.9 mills in 1980.

For small atomic power plants, the comparable figures are 18 mills in 1965 and 9.9 mills in 1980.

Relating this to anticipated conventional costs, NPA sees 7.8-billion kwhr of nuclear-generated power by 1965—half of it in New England and most of the rest in the Upper Midwest.

As atomic plants become more efficient, their use will spread until by 1980—when nuclear power output will total 377.7-billion kwhr in the U. S.—even the oil-rich Southwest will depend upon atomic plants for almost 8% of its power needs.

By that time more than 26% of

Future

power generation in New England is expected by NPA to be nuclear.

The result will be a loss of 116-million tons—or one-sixth of its potential market—by the coal industry. An estimated 410-million barrels of oil, and 538-billion cubic feet of natural gas, also are expected to be displaced by nuclear competition.

The fact remains that each of the conventional fuels will be supplying a far bigger slice of the energy pie in 1980 than will nuclear power, which will account for less than 10%. But in the ensuing years, atomic energy should improve its position steadily.

Power Cost Equalization Prospect

While the average price of delivered energy will go up 15 or 20% for the nation as a whole, introduction of atomic power may actually reduce costs in some regions. And, since nuclear power costs no more and no less in one region than another, there should be a gradual equalization of energy costs.

As NPA puts it "All the energy-intensive industries will find an additional degree of freedom in their choice of new plant location . . . Thus, the attractiveness of the aluminum industry of 4 or 5 mill power in the Ohio Valley now, as compared with, say, 7 or 8 mill power in New England, may decrease."

Factors such as manpower and proximity to raw materials and market will have more bearing on industrial location.

Obviously, there are some missing chapters in the NPA study. For one thing, it ignores any possibility that the next 25 years will see meaningful production of power from fusion reactors or from solar furnaces.

More important, it purposely sidesteps the question of private versus federal development of atomic energy—on grounds it is "irrelevant" to the economic issues.

Actual A-power development may lag behind the report timetable unless "the government is aware of its obligations in this field," said H. C. Sonne, NPA chairman.

Co-op's new building adds fuel as . . .

Utility Assessments Under Fire

A closer look at assessment methods and laws applying to utility property is being taken around the U. S. Varied approaches to property valuations for tax purposes have led to these developments:

Early this month Utah's attorney general ruled that two state laws limiting assessments on cooperative electric and telephone utilities were unconstitutional.

The action traces back to a county assessor who made an assessment against the new office building of Moon Lake Electric Association, Inc. His levy on the Vernal, Utah building skirted a law which says co-ops cannot be assessed more than $50 for each mile of primary transmission line and that other property is exempt.

State Tax Commission Chairman H. C. Shoemaker turned to the attorney general for a decision on the constitutionality of the law. It was held a violation of the state constitution's stipulation for "uniform and equal rate of assessment and taxation."

The adjustments in assessments against co-ops could not be made this year, according to Shoemaker, unless a court orders a change.

Ratios Ignored, PG&E Claims

In California, Pacific Gas & Electric Co has filed a suit challenging the assessment methods of the State Board of Equalization. The board is charged with disregarding local assessment ratios in its method of assessing utility property.

If the suit is successful and gains state-wide applicability, it would cause a multi-million dollar shift in the state's tax burden from the utility properties to the common property owners, said the board.

Filed on behalf of Pacific G&E's subsidiary, Pinole Light & Power Co, the suit asks the Contra Costa County Superior Court to award a refund of taxes paid last year under protest. Pinole L&P paid $11,302 in property taxes based on state assessments, PG&E claims. If levied at the Contra Costa County assessment ratio of 20 to 30% of market value, the taxes would have amounted to $6,782, PG&E said.

PG&E's property tax payment in Contra Costa County last year was $7,595,706, more than 50 times the company's tax payment in that county in 1935.

A Washington Water Power Co spokesman recently called for "putting our tax structures more into balance to encourage new industry."

Albert Gruber, technical research analyst told the Coeur d'Alene chapter of the Idaho Society of Professional Engineers:

"It's time we quit placing an unrealistic value on our power resources and get started on putting our tax structure more into balance to encourage new industry."

The inconsistency of Iowa's method of valuating utility property was the subject of a detailed report recently by the Des Moines Register. A "per-mile" transmission line valuation basis "spreads" the tax payments of power companies into rural counties, the article said.

It pointed out also that the tax commission arrives at taxable valuations for power companies by granting a 30% depreciation of the property's capital worth. Sixty per cent of the resulting figure becomes the taxable value.

Thus, while other Iowa businesses are assessed at about 26% of market value, power companies are assessed at about 42%.

Meet NEMA'S President

The Board of Directors of the National Electrical Manufacturers Association this month elected Joseph L. Singleton of Allis-Chalmers Mfg. Co to be new president of NEMA. Utility men know Singleton as a member of the Allis-Chalmers sales force, first as a district representative and later as a sales executive. More recently they have known him as vice president of Allis-Chalmers industries group.

Singleton has been associated with NEMA activities since the early forties and has been a vice president of NEMA for the past three years. Here in this special interview, he gives some of his current views:

Question: What NEMA activities do you expect to concentrate on as new president of that organization?
Answer: NEMA, was originally conceived to develop engineering and technical standards with the various segments of the industry which its members serve. This is a very worthy purpose and one that has helped reduce costs and bring a degree of standardization in a number of areas. As for my work at NEMA, I certainly plan to carry on some of the projects which my able predecessors have started.

I personally think the electrical industry has contributed more to the American standard of living than any other single industry. Working together, I'm certain we will continue to make our contribution.

Q: In what areas can NEMA and the electric utilities most appropriately work together for the progress of the industry?
A: There again, we have worked and can work toward evolving technical standards for our mutual benefit. EEI-NEMA committees have worked in many areas and made valuable contributions.

Q: What about cooperation in various promotional activities?
A: Well that is a matter for the various NEMA sections—not the overall NEMA organization. NEMA itself does not conduct these activities, but several NEMA sections do carry on various promotional programs.

Q: Along that line, what do you think of the "all electric" promotion program recently approved by the EEI board. And what role can the manufacturers play in this program?
A: In the first place, any promotional activity that sells electric living is a step in the right direction. That's what we live on. The more people selling the better off we all are.

As to your second question, I think manufacturers can cooperate most effectively by selling the "all electric" idea through ads that best serve their own individual interests. That's the way we've supported the Housepower campaign. With the wide diversification of manufacturers' interests, that is the only way we can support the broader industry promotion programs.

Q: We know that you've spent the past week on an intensive business trip. You've talked with utility executives and other businessmen over the country. What is your view of present business conditions and the immediate business outlook?
A: I do believe we have hit the bottom of this slump and I confidently expect that general business conditions will improve during the remainder of this year. We have definite signs of this in our own company. Generally utilities have kept pretty much on their construction schedules, and this is their biggest year yet for heavy construction. There may be some slackening in this particular area next year, but it will still be a pretty good year.

Q: Do you find business leaders generally optimistic?
A: I'll tell you. I talked with about seven groups last week and I didn't find a pessimist in the crowd—Not a one. Some areas such as the Southeast and the Southwest have hardly felt this slump. It appears to have been felt more here in what I call the midwest area but which some people call the "north central" area.

"Any promotion program . . .

that sells electric living . . .

is step in right direction . . .

Washington Wire

• Trio officially in office

The Atomic Energy Commission's new chairman was sworn in and two TVA directors were confirmed by the Senate last week.

John A. McCone took on the AEC post replacing Adm Lewis Strauss, who will serve as the President's atoms-for-peace advisor.

• The Senate Public Works Committee surprised almost everyone in Washington by voting unanimously to recommend the nominations of Dr Frank Welch and Arnold Jones as directors of the Tennessee Valley Authority. Welch's term will expire in May, 1960, and Jones' term in May, 1966.

Although a favorable vote was expected, its suddenness and unanimity were not. The committee's vote takes pressure off the TVA bond-financing bill before Congress.

Congressional approval of a bond-financing bill is still a good possibility this session, although the final version probably will include several restrictive amendments similar to the Senate-passed Kerr bill.

Three factors are working in favor of such a bill: **1.** Strong insistence from congressmen in "TVA country." **2.** White House support for a limited bill. **3.** Apparent strength mustered in earlier votes by the Senate and in the House Public Works Committee.

The Kerr bill would place a $750-million limit on the amount of bonds outstanding at any one time; limit sales from power facilities built by bond-financing to the Tennessee River drainage basin or the power service area on July 1, 1957; and require certain notification of proposed bond sales to the Treasury and notification of construction to Congress. The Jones-Davis bill has no such restrictions.

BRIEFS: An FPC examiner has okayed Consolidated Edison Co's plan to buy up to 50 mcf daily of natural gas for Waterside steam plant. Con Ed will buy it at 19.25¢ per thousand cubic feet from Texas producers. Transco will pipe it for an added 23.28¢ per thousand. Converting Waterside from coal to gas will ease air pollution problem.

McCONE JONES WELCH

Pacific G&E's proposed partnership approach to Trinity River, rebuffed by the House Interior subcommittee on irrigation and reclamation, only can be considered now at a special subcommittee meeting. If the contract fails to clear Congress early next year, federal power advocates will seek an appropriation for U.S.B.R. to build its facilities.

U. S. Power Picture

• Power companies puzzled by outages in three states

Failure of a 13/132-kv, 15,000-kva transformer at the Kearny Generating Station touched off a series of incidents that resulted in service interruptions to 600,000 customers on Public Service Electric & Gas Co's system on July 2. Service to almost all of the customers was restored in less than an hour.

The failure, of unknown origin, resulted in a severe explosion. An oil fire developed and enveloped a 132-kv tie bus causing a three-phase bus short circuit in the Kearny switchyard.

The multi-relay protecting this bus failed to trip because of mechanical trouble and caused all of the 132-kv circuits on the Kearny bus to trip at the far end. Seven turbine generators then in operation at Kearny (462-Mw total capacity) tripped or were manually shut down because there was no outlet for this power into the system. The severe voltage disturbance on the system caused by the short circuit at Kearny knocked out the auxiliaries at Linden Generating Station where it was necessary to tripout one generating unit carrying 240 Mw. The loss of generation at Kearny and Linden together with the tripping of the Kearny 132-kv circuit overloaded Marion Station.

Marion, which had 142-Mw of capacity in operation, tripped out and it was necessary to trip all 26-kv feeders at Bergen Switching Station to relieve the 132-kv transmission overload.

On June 17 an operating error at Louisana Power & Light Co's Sterlington Station "dumped an instanteous and unexpected load on the Mississippi Power & Light system and on the generating plants at Natchez, Cleveland, and Jackson," an MP&L spokesman told newspaper reporters.

"These plants were not running at full capacity at the time and the sudden load tripped the generators out," he added. The outage exceeded 600 Mw.

LP&L engineers still are investigating the origin of the trouble at Sterlington Station where a new 210-Mw unit carrying full load evidently was tripped off accidentally while its protective relays were being adjusted and checked.

Almost all of LP&L's system was down for from 20 minutes to one hour. LP&L service was interrupted in all but its southern area.

A freak accident cut off power to sections of Charleston, S. C., for up to an hour and a half July 2. When a grading machine punctured a South Carolina Electric & Gas Co natural gas line, 60-ft high flames burned two 110-kv lines and a 44-kv line.

Atomic Progress

• Authorization bill passes

• The House of Representatives last week passed the fiscal 1959 authorization bill for the Atomic Energy Commission with only a smattering of opposition. Senate approval followed on July 15 with only minor changes.

The $386-million measure authorizes federal construction of a 40,000 kw gas-cooled reactor unless private industry comes off with an acceptable offer within 90 days after enactment.

It also calls for construction of a $145-million plutonium producing reactor at AEC's Hanford works which could later be converted to power production. And it requires AEC to submit reports on design studies for five other reactors by next spring. This has been interpreted as a move to prepare for authorization of more federal reactors next year.

The principal opposition to the bill came from the coal industry. Even so, utility industry strategists who had refrained from involvement in the House battle were surprised at the ease with which it was whooped through the House.

Not a single Republican—and not a single member of the Joint Committee on Atomic Energy—stood up in opposition. Not a single amendment to the bill was offered.

All this in the face of a letter from President Eisenhower objecting strongly to authorization of the plutonium producing reactor and the mandatory design studies. Still, a Presidential veto is discounted because of key military items in the bill.

It is taken for granted that Congress will vote, in separate legislation, adequate appropriations to implement the Democratic program included in the bill. If so, there remains only one barrier to the Democratic program: Possible refusal by the President's Budget Bureau to release the funds for the program.

Rates and Regulations

• Montana Pwr gets 12%
• PUC sets tax hearings

• Montana's PSC authorized $1,466,800 rate increase for Montana Power Co early this month. The increase, first since 1912, amounts to 12% and will bring a 5.33% rate of return (vs 5.56% held reasonable for a phone company's recent bid for an increase). Proposed boost of residential rates was trimmed from 19 to 12%. The company's plant valuation was cut $1,629,022 mainly on disallowance of working capital, reduction of materials and supplies allowance, and elimination of out-of-state properties value.

• California's Public Utilities Commission will investigate federal income tax law provisions involving accelerated amortization and accelerated depreciation.

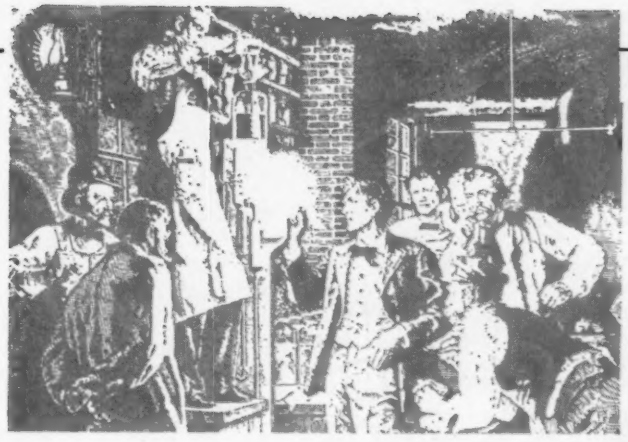
A commissioner will be assigned to the project and public hearings will be held at a time and place not yet designated. All public utility corporations in the state were made respondents and will be able to testify, the PUC said.

Notice of the investigation was given in San Francisco when the PUC authorized a $9.5-million increase in Pacific Gas & Electric Co gas rates. The PUC deferred action on the issue of normalization of tax payments resulting from accelerated depreciation, which was discussed at the PG&E hearings.

BRIEFS: Northern Berkshire Electric Co is seeking a $219,000 yearly increase, before taxes . . . Rhode Island Supreme Court rejected Narragansett Electric's appeal for review of 5.84% rate of return stipulated by DPU. The company sought a 9.4% rate boost.

GATEWAY MARKER near Hopkinsville, Ky., is being duplicated at 22 other highway entrances to TVA region. Sponsored by Citizens for TVA and local distributors of TVA electricity, the 44-ft long, all-metal signs carry slogan, "We Pay For It . . . You Own It!

COAL-TO-ATOM SWITCH at Consumers Public Power District's 100-Mw Hallam, Neb., plant occurs in '62 when sodium-graphite reactor is completed. At groundbreaking, W. Sequeira, Atomics International; CPPD Mgr R. L. Schacht; Rep Chet Holifield; J. S. Graham, AEC, inspect model.



LIGHTING: Utilities Look Again To Their Birthright

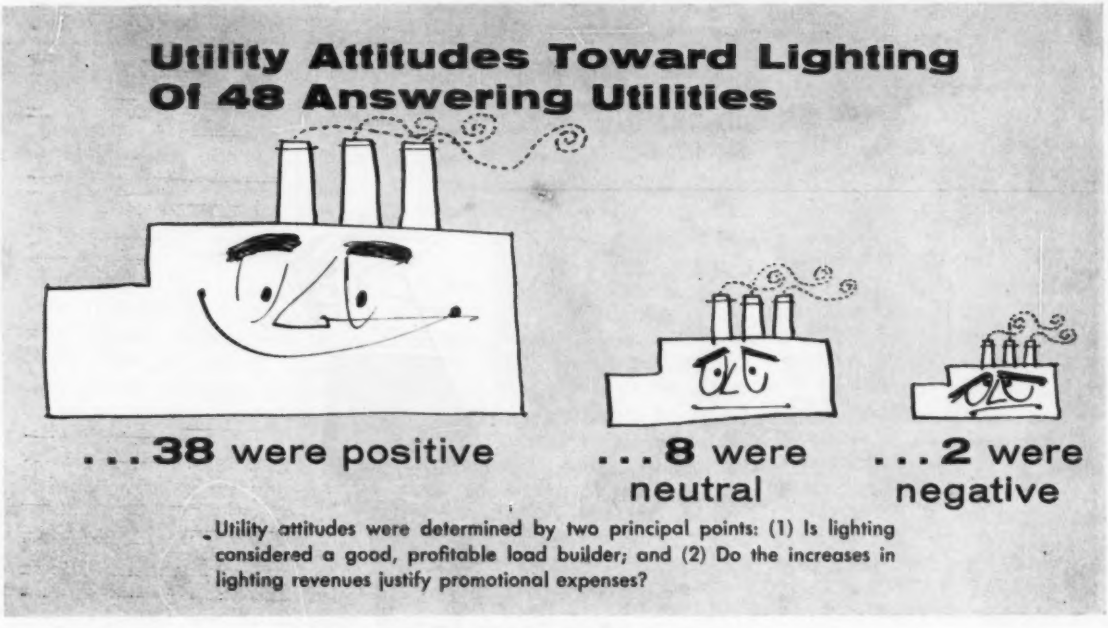
T. R. JORDAN
Commercial Editor

Lighting—the load which gave the electric utility industry its birth—is again being considered by that industry for what it is: a good load builder, well worth the manpower and money which goes into its promotion.

This is the principal finding of a recent survey conducted by Electrical World of 50 utilities on their lighting promotion practices and needs. Some of the specifics which back up this general conclusion: (1) Utilities are putting more manpower into lighting sales than they were 10 years ago; (2) The emphasis is being placed in the commercial and industrial fields rather than the residential, because this is where the money is; (3) There is a general realization among the power companies that lighting has a good load factor, and that even when compared to other loads, it holds its own as a revenue producer.

It was necessary in the opening sentence above to say that lighting was "again" being considered as important. This is so because it has been only recently that many companies elevated lighting from a "stepchild" status. In the early days of the industry, lighting was the principle, in some cases the only, load. But utility attention shifted to the more "dramatic" applications—the vast array of electric appliances and housewares in the home and the almost infinite number of applications for electric power in commerce and industry. That attention is now coming back to lighting.

What has caused this renaissance in utility thinking about lighting? Answer: A number of things, among the most important of which is the belated realization that lighting has some excellent load characteristics; that it is a good revenue producer (especially in the commercial and industrial fields); that it, like so many other loads, will help provide answers to the problems caused by rising capital costs and appliance saturations; and that generally,


Utility Attitudes Toward Lighting
Of 48 Answering Utilities
. . . 38 were positive
. . . 8 were neutral
. . . 2 were negative
Utility attitudes were determined by two principal points: (1) Is lighting considered a good, profitable load builder; and (2) Do the increases in lighting revenues justify promotional expenses?

utilities may be moving into an era in which they will no longer be able to take load growth for granted.

Who Did the Survey Cover?

The survey sampled some 50 utilities around the country. These represented 14,968,328 meters, or about 27.1% of the total. Breakdown of the meter representation:

- 12,957,900 Residential and Rural
- 1,802,600 Commercial
- 207,328 Industrial

Some 48 of the 50 companies gave their "attitude" toward lighting, i.e., how they regarded it as a load builder, and whether or not they thought results justified promotional expenses. For classification purposes, answers were grouped into three categories: positive, neutral, and negative. Thirty-eight companies reported a positive attitude, eight were neutral, and two didn't like lighting at all.

Of the 38 who liked the lighting load, many stipulated that they felt they could better justify commercial and industrial lighting than they could that for the home (this was later borne out by the survey findings on earnings per lighting kw.) Said Seattle City Light's Electric Sales Supervisor J. D. Gawne: "Because of the promotion of electric cooking and water heating, little attention is given to residential lighting. Commercial and industrial lighting provide load balance and are excellent sources of revenue." Or listen to E. A. Wilson, Alabama Power Co general sales manager: "We believe the lighting load to be definitely profitable, not only because it is a good load in itself, but because of its direct benefits to the customer and the general economy (particularly industrial, commercial and farm). Looking at it from either aspect, its advancement justifies a reasonable promotional expense budget."

'Thumbs Down' Comments

But there were some thumbs down comments, too. The VP of one good-sized eastern utility put it this way: "Commercial lighting is a profitable load. Industrial lighting is less profitable. Residential lighting is still less profitable and present promotion methods are not worth their costs."

It is one thing for a power company to express a favorable attitude toward lighting, and quite another for it to do something about it. One good way is for the company to back up its position with money and manpower.

The EW survey shows that so far as manpower is concerned, most companies are doing just that. In 1948, the average company had one lighting salesman for every 2,500 to 3,000 commercial and industrial customers. Today the situation is much better. The 50 companies in the Electrical World survey today average one salesman to every 1,550 commerical-industrial customers. Allowing for the fact that 10 years ago, many companies were still recovering from the wartime manpower shortage, this decrease in the number of accounts that each lighting salesman has to service (or increase in the number of salesmen, depending on which way you prefer to look at it) means that each salesman's "customer coverage" ability has been upped about 60%. Or, in a less theoretical interpretation, it means that he can give more attention to each customer, thus increasing his chances of selling a higher quality, more profitable lighting job.

Sales Training Surprises

Answers to questions on sales training held some surprises. Asked whether they gave their salesman a training course, 40 of the 50 companies replied in the affirmative. Perhaps equally significant is the fact that six companies, or more than 10%, replied that they gave their salesman no training whatsoever! (Four compaines did not an-

swer.) Training courses ran the gamut from a kind of "let's-play-it-by-ear" tutelage of one experienced salesman to his fledgling, to elaborate sales training programs with visual aids, tests and field experience. Many companies use the Illuminating Engineering Society's Lighting Fundamentals Course as a primer. A considerable number also reported that they avail themselves of manufacturers' facilities. Chief among these were the courses at General Electric Co's Nela Park and the Westinghouse's "Modern Illumination Techniques."

Quotas Not Used Much

Salesman's quotas—a common device used in the commercial activities of many utilities—seemed to be slighted by the companies answering the survey. Only 13 of the 45 companies answering the quota questions said they set some kind of goal in lighting sales for their salesmen. Thirty-two have no quotas. (Five did not answer.) Of the 13 who do use quotas, nine answered the question on what they wanted the salesman to reach. There was great variance in these answers, and striking an average of the nine answers would be statistically unsound. However, here are some typical answers:

"1,000 kw per year."

"$16,500 EAR per salesman per year."

"16,571 kw per year."

"600 kw per year."

"500-800 kw per year."

"Quota assigned each year, depending upon general economic conditions."

What kind of load and revenues can be expected from lighting? Answers to this, as was expected, showed considerable range of opinion. But one point came through exceedingly clear: It depends upon the kind of lighting you're talking about. Any analysis of utility lighting loads and revenues must begin with a breakdown of the market into its residential, commercial and industrial categories.

It was felt that, because of the great differences in the nature of service territories, that an "average connected load (kw)" would be meaningless. So would an "average annual revenue." It seemed more significant to tie these together to ascertain the average annual earnings of a kw of lighting in each of the three markets.

Commercial Market Leads

The commercial market is by far the lighting earnings leader. Among the 13 companies who gave the necessary data to determine their earnings per kw of lighting, the average for the commercial market was $33.60 per year (see chart on p 64). These same companies averaged $19.65 per kw per year in the residential market, and $27.95 in the industrial. The reason for good commercial earnings: High load factor and a good rate.

Rates Above National Average

Speaking of rates, the survey asked for rates at which lighting was sold in the three market categories. Some 39 companies answered. Average residential rate was 2.9¢. This is 13.3% above the national average given in the EEI Statistical Bulletin for the year 1957. Average commercial rate for the 39 EW survey companies is 2.78¢, 3.6 mills or 14.9% above the average. Industrial rate for the survey companies was 1.74¢, compared to 0.92¢ for the national average.

Twenty-six companies replied to the questions concerning their lighting load factors. It should be remembered that most of these were estimated, the companies being unable to determine them exactly. But even averaging the estimates confirms what was expected: namely, that the commercial market would do the best. It had, for 26 companies, an average lighting load factor of 35.7%. Industrial came in second with 32.9%; and residential was lowest with 18.6%.

When it comes to lighting promomotions, the surveyed companies exhibited an apparent shyness or unwillingness to talk about their activities. Asked to list the major

Utility Manpower in Lighting

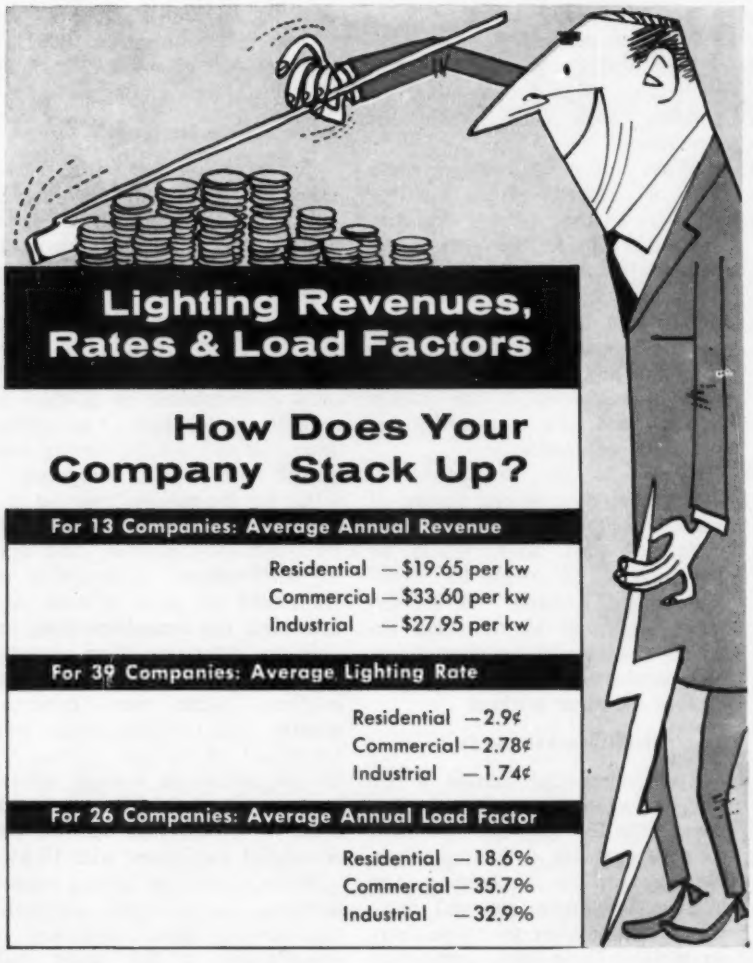
In the last 10 years, the ratio of the number of lighting salesmen to the number of commercial-industrial customers has increased, meaning better customer coverage per salesman.

Training

Of 50 Utilities:
40 have required training courses
6 do not

Quotas

Only 13 set a salesman's quota
33 do not


Lighting Revenues, Rates & Load Factors
How Does Your Company Stack Up?
For 13 Companies: Average Annual Revenue
Residential — $19.65 per kw
Commercial — $33.60 per kw
Industrial — $27.95 per kw
For 39 Companies: Average Lighting Rate
Residential — 2.9¢
Commercial — 2.78¢
Industrial — 1.74¢
For 26 Companies: Average Annual Load Factor
Residential — 18.6%
Commercial — 35.7%
Industrial — 32.9%

lighting promotions which they have carried out for the last five years, most companies left this blank. Many of those who did answer listed only some general promotional framework, such as Live Better Electrically.

The emergence of the commercial lighting market as the most attractive to utilities was again accentuated when they were asked to describe those promotions which they regarded as most successful. Again and again, commercial applications cropped up: "Store lighting . . . because it's easy to reach and sell, and it gets the best results."

"School lighting . . . we're putting it in both new and old buildings."

"Our commercial lighting campaign conducted in the fall of 1957 was considered successful. It was directed generally to small customers whose kwhr revenue would be above average and where the additional lighting load would, to some extent, avoid the summer peak loads."

How They Promote

How do electric utilities go about promoting the lighting load? What techniques and services do they usually employ?

These and other questions about the day-to-day, door-to-door selling activities of lighting were asked of the surveyed companies. The results are tabulated on p 65.

So far as media were concerned, the surveyed companies say they use two principle items: mailing pieces and educational material. The mailing pieces are usually bill enclosures, and most frequently are aimed at the residential customers. The general feeling is that direct mail pieces provide a relatively cheap way to approach a market, that from the revenue and load standpoints, holds the least promise. This, of course, is in line with the basic promotional premise that the media's cost must be proportional to the results it is expected to produce.

Educational material, almost always more elaborate and expensive, must also follow that premise. It is particularly well suited to the commercial and industrial markets for two reasons:

- Lighting must be sold to a business as a cost-of-doing-business item. It must, therefore, be justified on the basis of its contribution to better efficiency and higher profits. This requires a detailed, factual type of presentation.
- Its greater cost is matched by the expected greater returns in load and revenue.

Radio & TV Pitched Toward Homes

The use of radio and television spots was surprisingly high. The target, of course, is the residential market. Eighteen companies reported that they used radio and TV.

Posters and dealer displays, fairly common point-of-purchase promotional items, were used by only 15, or 30%, of the reporting companies. Big reason for the relatively low number using them is that they are almost always available from lamp bulb manufacturers.

Newspaper advertising is also not a favorite for lighting promotion. Only 14 companies use it. A mere 12 use car cards and an infinitesmal six use lighting promotion pieces on the sides of their trucks.

Perhaps the words of one utility executive at a recent lighting sales conference at GE's Nela Park provide the key to boosting lighting sales, at least in the residential market: ". . . After all, we're selling the lighting, and not the lights. Our product may be energy, but what we have to sell the customer, particularly the housewife, is a beautiful or functional effect."

This helps explain why almost 60% of the surveyed utilities, despite the fact that they have dropped merchandising appliances and housewares, continue to merchandise bulbs. Twenty-nine said they do, and of these, 26 sell colored bulbs. This colored bulb activity is

significant from a merchandising viewpoint: The fact that many companies still sell white bulbs might be dismissed as a holdover practice from previous years, but because an almost equal number also push colored lamps, and these colored lamps have been available only during the last few years, it indicates a consciousness that lighting has to be demonstrated—or in other words, its effect must be shown to be sold.

'Bag of Bulbs' Used by 25%

"Bag of Bulbs" promotions, a long-time utility sales gimmick, drew support from about 25% of the reporting companies. One company feels that results do not justify expenses. But of the companies that do use the "bag of bulbs" idea, these are the size bulbs used, in the order of their popularity:

(1) 100 w
(2) 150 w
(3) 60 w
(4) 75 w
(5) 40 w

The idea of giving away free bulbs, another popular practice in the industry's early days, is not looked on with much favor today. Only 20% of the companies use it. Again, the feeling is that it is just too expensive for what the power company gets from it.

Quit Selling Lamps & Fixtures

But if most power companies continue to sell bulbs, many have pulled in their merchandising horns on portable lamps, and all but one have quit selling fixtures. The reason is not hard to find. From a utility point of view, lamps and fixtures are very much like appliances and housewares. There is, in almost all service areas, an adequate distribution setup through retailers; and equally important, lamps and fixtures, like appliances, require a fairly high level of inventory (both physical and financial) and have an increasingly slimmer margin of profit. True, the utility is more interested in the energy sold than in the lamp or fixture which consumes it, but there is a ratio point beyond which they cannot go.

One of the most promising residential promotion packages is Live Better Electrically's Medallion Homes program. Across the country it is supported now by 180 utilities. In the EW survey 37, or 75% of the companies use it. Medallion Homes sells the all-electric concept, and residential lighting is bound to be pushed upward by the "coat tail" effect of the other loads.

So much for residential lighting. How do utilities push the commercial and industrial markets? The selling keyword is Service—service in providing layouts, in supply technical and engineering information and assistance.

Forty-seven of the 50 surveyed companies reported that they provide lighting layout help for their customers. In 1956 these companies made up for their customers 10,626 commercial and industrial lighting layouts. In 1957, the number climbed to 14,088. As of May 30 this year, 6,579 layouts had come off the drawing boards. If this rate continues throughout the rest of '58, these 50 companies will have put out about 15,500 layouts. Principle reason for the drop in layout growth rate is probably the recession. The decrease in capital spending, either for new plants or modernization of existing ones, is reflected immediately in commercial and industrial lighting sales.

Only a fraction more than 10% of the reporting companies have adopted National Lighting Bureau's Certified Lighting Program. One

How They Promote

(Based on 50 Utilities)

Media

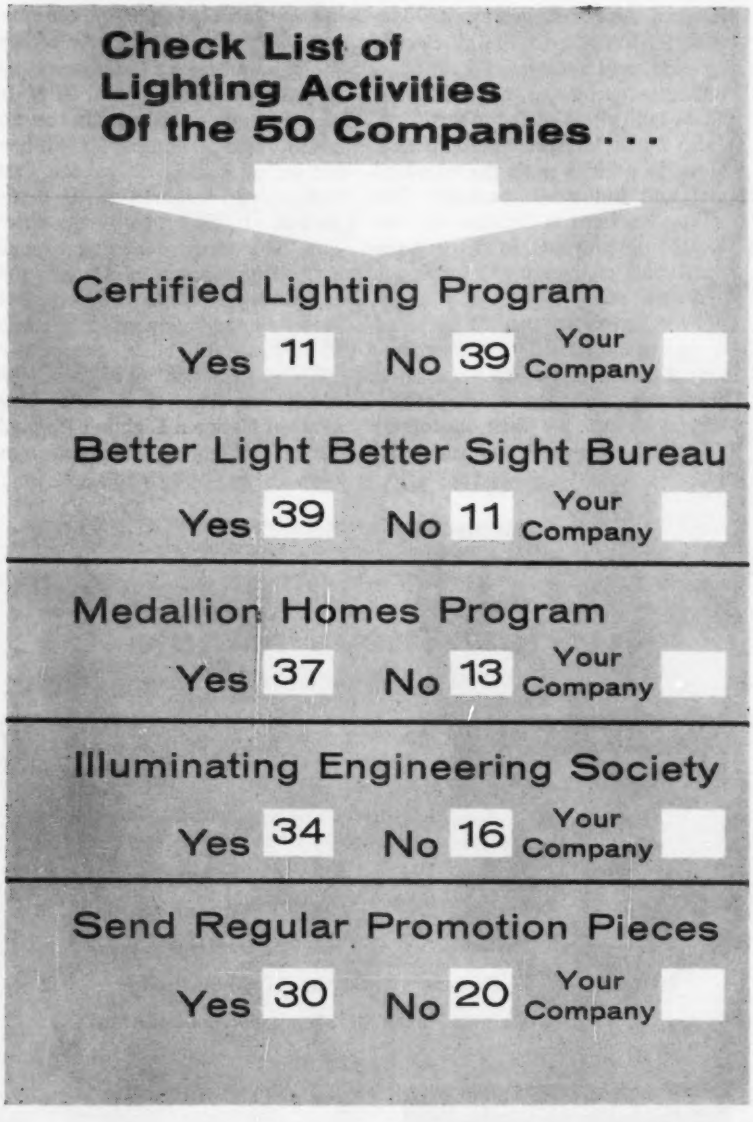
Media	No. of Companies Using	Media	No. of Companies Using
Mats	14	Car Cards	12
Radio	18	TV Spots	18
Posters	15	Dealer Displays	15
Truckcards	6	Co-op Advtg.	16
Mailing Pieces	32	Educational Mat.	31

Merchandising

10 Free Lamps
29 Merchandise Bulbs
12 Merchandise Portable Lamps
1 Merchandises Fixtures
13 Use 'Bags of Bulbs' Promotions
26 Merchandise Colored Lamps
9 Hold Contests

Services

47 Provide Lighting Layouts


Check List of
Lighting Activities
Of the 50 Companies . . .
Certified Lighting Program
Yes 11 No 39 Your Company
Better Light Better Sight Bureau
Yes 39 No 11 Your Company
Medallion Homes Program
Yes 37 No 13 Your Company
Illuminating Engineering Society
Yes 34 No 16 Your Company
Send Regular Promotion Pieces
Yes 30 No 20 Your Company

principal objection is the certification requirements. They can be an obstacle to future lighting sales. The tendency is for the customer to feel that once his installation has a certification, he can make no further improvements. And he points this out to the salesmen, in effect saying, "You certified this job yourself only a few years ago. And now you tell me it's obsolete!"

But NLB has a prescription for this situation. Last week it announced its new "Eye Fidelity in Lighting" program which emphasizes even more strongly the quality of a lighting job, but makes the certification provisions optional.

Although queried about lighting budgets, most companies were either unwilling or unable to give a breakdown of lighting promotion dollars. Most were not even able to give lighting budgets as a percentage of total promotion budgets. Unquestionably the lack of these figures can largely be explained by the difficulty in extracting them. But it may also be true that with the general recession-generated slashing of promotion and advertising budgets, lighting has come in for a deeper cut than other loads.

Do utilities need help in pushing their lighting loads? The answer is an emphatic "yes!", and it will be welcome from trade associations, manufacturers, trade allies or any other quarter.

Help can take the form of promotional materials of all kinds or personal assistance on technical problems. Asked what kind of materials they would like to receive from manufacturers, the overwhelming majority of utilities asked for mailing pieces and educational material. This is in line with their own promotion materials program.

Need Better Local-Level Tie-ins

Most utilities expressed a need for better local level tie-in activities with manufacturers. Queried as to how often the lamp manufacturer's representative should call on them, almost half (23) said they'd like to see him once a month (One even said twice a month.). Another 18 companies said the local rep should call at least once a quarter. Only two utilities want to see him at least every six months; and if he calls any less frequently than that, he shouldn't bother coming at all!

Utilities would also like to see manufacturers coordinate their national promotions more closely with EEI's promotion calendar. They feel that this will give better support to their local efforts, which in many cases, are based on the calendar.

Give Their Trade Allies Help

They would also like to see the kind of technical help and trade assistance come forth from manufacturers that can be passed on to their local trade allies. Here, the majority of requests are for information on equipment and product changes, especially those for the commercial - industrial market. There is also considerable interest for application data for new equipment and products.

Several companies mentioned that the electrical contractors in their areas are slowly taking over much of the necessary technical assistance to the customer as they become more qualified to do so. Utilities would like to see training materials which would speed this process along.

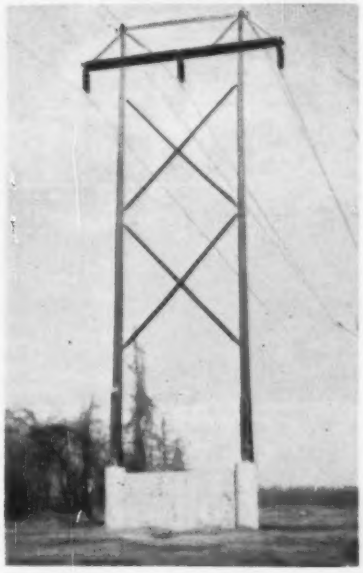
They are, in short, looking for the kind of help which is going to push their lighting loads—especially the commercial and industrial—back up toward the high positions they held in former years.

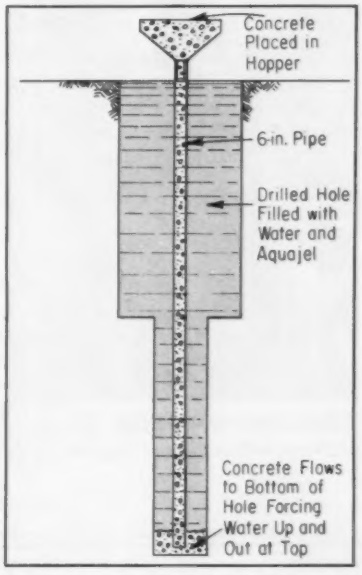
Special Mud Firms Up Tower Footings

Tower footings in quicksand are made solid by Southwestern Gas & Electric Co through use of an oil field compound called Aquajel. The compound stiffens the earth upon contact and seals the wall of the hole being drilled. This material was used in the building of a new 1,850-ft Red River crossing to replace a 1,525-ft span that had been washed out.

Drilling in the quicksand, to reach solid ground at an 87-ft depth, required measures to prevent the wall of the hole from collapsing. About every 20 ft of drilling, water was pumped into the hole, Aquajel was added, and the solution was mixed until it reached a consistency which would seal the walls.

After the holes were drilled, concrete was poured from the bottom of the hole to force the water-Aquajel mixture out. This was done by dropping a 6-in. pipe to the bottom of the hole, with a concrete hose attached to the bottom of the pipe. Concrete was reinforced by dropping in steel reinforcing rods during the pouring operation.



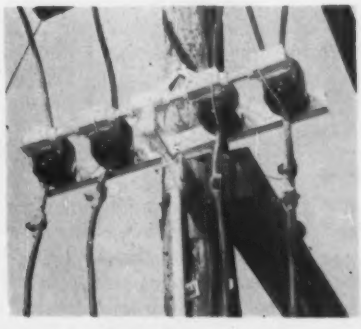

Concrete Placed in Hopper
6-in. Pipe
Drilled Hole Filled with Water and Aquajel
Concrete Flows to Bottom of Hole Forcing Water Up and Out at Top

FLOOD-PROOF STRUCTURE rests on two piers which go 87 ft down to solid ground. Holes for piers were kept from caving in with Aquajel-water mixture

For protection against flooding, a concrete wall joins the two pier structures. Two 16-in. steel pipes were set to half their 20-ft length in the concrete piers; then two 80-ft wood poles were lashed to the pipes. The wall prevents brush from piling against the structure.

Molded CT's Give Neat Appearance

JOHN A. BROWN, Allis-Chalmers Mfg Co, Knoxville, Tennessee and
H. S. EDWARDS, Metering Superintendent, Mountain Division, Kentucky Utilities Company, Pineville, Kentucky.

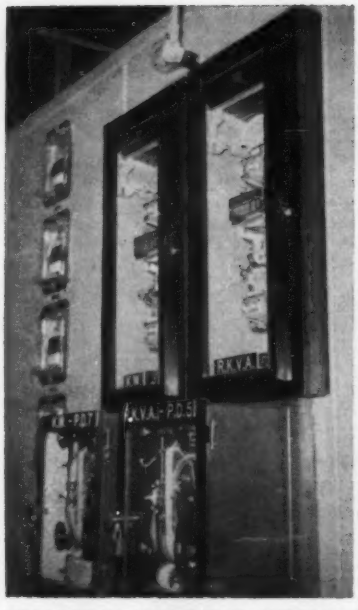


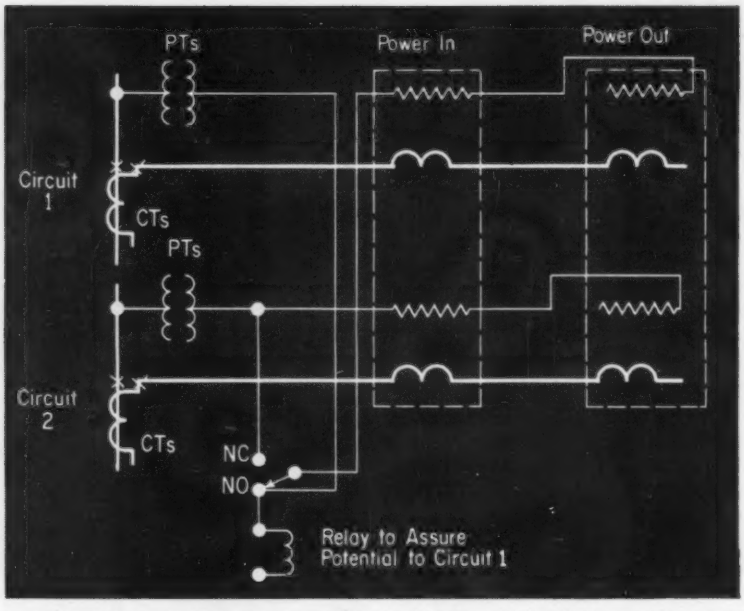
Kentucky Utilities Co has developed some neat-appearing metering installations by using "window type" current transformers encased in a thermosetting resin. Molded CTs elminate bolted connections, and have characteristics ideal for outdoor installations, thereby substantially reducing installation time and cost.

The CTs are mounted on a 3-in. steel channel which facilitates installation on a pole or building wall. The channel width is the same as the length of the CT, adding to the appearance of the job.

The elliptically-shaped window of the molded CT will hold two 750 Mcm conductors with 600-v insulation. Secondary leads may be brought in from either side of the transformer by reversing the cover. Terminals are covered by threadless conduit boxes having 1-in. fittings.

In a single-phase metering arrangement, one of two CT's can be mounted on the pole or on the side of a building. This type of arrangement is equally suited to three-phase metering. The illustrated installation has both single-phase metering, left and three-phase metering with two CTs for each. The lighting circuit and the three-phase circuit are from separate sources.





TOTALIZING WATTHOUR METERS of the multi-stator type measure power flow in Niagara Mohawk Power Corp connections with industrial customer's power system. Auxiliary relay maintains coil potential when bus-tie breaker opens

9,000-Kv Sub Rides Highway on Trailer

P. F. HARGREAVES, Engineer, Puget Sound Power & Light Co, Bellevue, Wash.

A 9,000-kva highway-trailer mobile substation has been in constant service on Puget Sound Power & Light Co's system since last year. The new unit was made necessary by inability of an older 2,500-kva unit to carry growing substation loads during emergencies and scheduled shut-downs.

The substation will supply 2.52- or 7.56-kv delta or 4.36- or 13.09-kv grounded wye distribution from 55- or 66-kv subtransmission. Ten primary taps and a secondary terminal board on the 9,000-kv, 3-phase, FOA transformer provide this operational flexibility.

The unit has a group-operated 69-kv retractable primary disconnecting switch, HV station-type lightning arrestors, 1,000-Mva primary fuses, and a 5-cyc, 14.4-kv, 250-Mva reclosing oil circuit breaker with overcurrent relays. Either 3- or 9-kv arrestors can be connected to the outgoing feeder.

The OCB rating was held to 1,200 amp to save weight. This limits output to 5,250 kva at 2.52 kv, a little-used industrial-customer voltage, but the breaker can be bypassed for higher output at 2.52 kv. At 4.36 kv and up, the breaker carries full mobile substation rating.

An air-filled junction box was specified for the secondary terminal board, to avoid lowering transformer oil level or working in the oil while changing LV coil connections. Voltage and polarity changes are quickly made by merely opening locked doors and changing studs and links.

A semi-trailer with dual rear axles simplified the problem of meeting State of Washington axle-loading requirements, thus reducing the cost of the special permit needed each time the unit is moved on a state highway. The trailer has air brakes on both axles, chock blocks, accessory cabinets, spare fuse boxes and necessary running and clearance lights.

The complete assembly is just over 35 ft long, weighs 54,180 lb, and has an 8-ft transportation width. The area's many 14-ft-clearance bridges are traversed safely with a 13-ft 1-in. maximum transit height.

Special attention was given the problem of setting up on uneven, rough or sloping terrain. Individually controlled hydraulic jacks, two in front and two in rear, provide efficient means for leveling the unit, removing load from the tractor, and taking weight off the tires if parked for any length of time.

The trailer front end provides dead-ending facilities for the incoming line. The outgoing feeder can take off to right, left or rear from the rear end, a convenience which often eliminates setting a pole.

A meter compartment encloses recording demand

Read Tie-Line Power with Totalizing Meters

HAROLD F. CROTTY, Application Engineer, General Electric Co, Schenectady, N. Y.

Multi-stator totalizing watthour meters give practical, accurate readings of power exchange at multi-circuit interconnections. Two such installations, one ratcheted "in" and the other "out", determine the net directional power flow.

Interconnections between utility systems, or between a utility and an industrial power plant, often involve two or more circuits. Power flow may be totalized readily on a multi-stator meter with characteristic watthour meter accuracy. Power reversals record instantly to give net differential power flow and energy. Furthermore, net differential power demand may be registered either by direct mechanical connection or by electrical impulses to a demand mechanism.

Data recorded in this manner determine the net power flow and demand for billing purposes. They can also be telemetered to control centers for system dispatch and control.

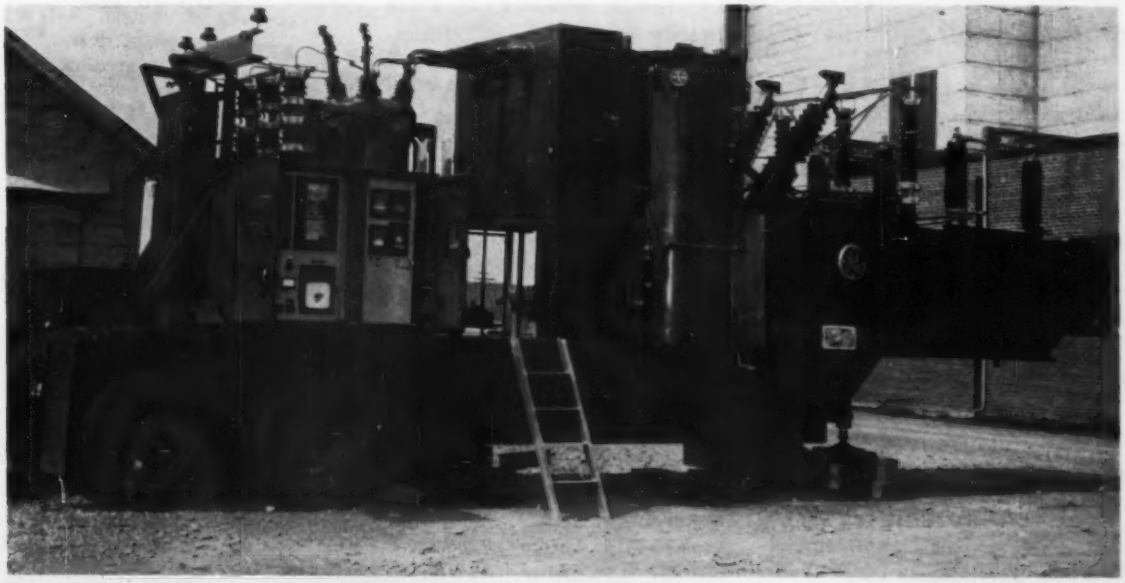
The ability to convert power reversals on one or more circuits of an interconnection to instantaneous changes in torque gives multi-stator meters a considerable advantage over individual circuit directional meters where net total demand and net total energy must be measured. Thus their inherent differential and directional features give a new aspect to the totalizing meter previously designed for totalized metering at power stations.

Calibrated accuracy may be maintained during periods when one of the circuits in a multiple interconnection is de-energized by switching the corresponding meter potential coils to another source. This can be done with an auxiliary relay.

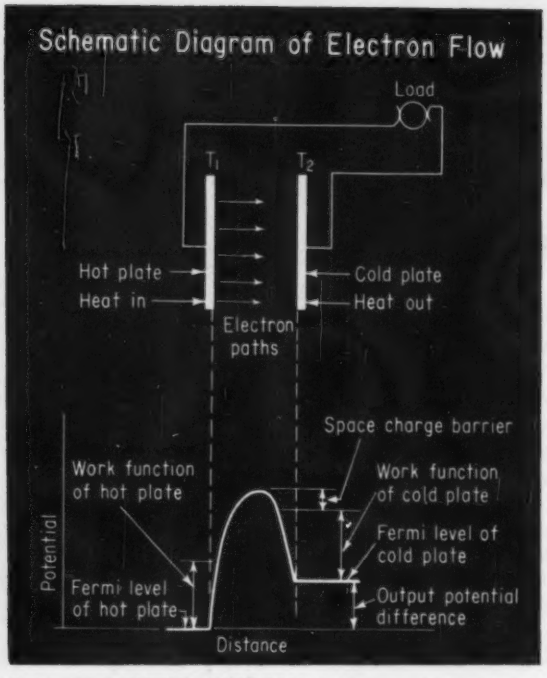
meters, a recording voltmeter with transfer switch, and three indicating ammeters. Also included are the OCB control switch with indicating lamps, control power switches, and a phase-rotation and undervoltage relay to prevent closing the OCB unless transformer oil pump and cooling fans are energized.

From moment of delivery, the mobile unit has been in almost constant use, permitting substation modifications to be made de-energized, and thus more efficiently and safely.

A portable fence, built in sections, encloses the substation when operated in locations open to the public.



MOBILE SUB on 35-ft trailer gives complete 13.09/7.56/4.36/2.52-kv switching and protection from 66/55-kv transmission. Hydraulic jacks level the unit and take weight off tires



PLOT OF ELECTRIC POTENTIAL between plates gives a representation of the barrier which the electrons must surmount to supply current for an external load

THERMO-ELECTRON engine has no moving parts. It can convert heat directly into electricity. In the working model electric heaters supply the thermal energy

Heat Gives Electricity Directly

Thermo-electron engine developed by MIT professors produces small quantities of electricity with 12% efficiency

A significant research development in the field of thermoelectric conversion of heat directly into electricity is in progress at the Massachusetts Institute of Technology. Drs. G. N. Hatsopoulos and Joseph Kaye of the Mech Engr Dept have produced a working model of what they call a thermo-electron engine. The apparatus has no mechanical moving parts. Its efficiency at present is about 12%, but one of 30% appears feasible.

Basically the electronic heat conveyor consists of two metallic plates, one relatively hot and one relatively cold inside a vacuum tube. Heat is applied to one plate at about 2,300F. The other plate, spaced less than 0.001 in. away, is maintained at about 1,000F. In operation electrons are boiled off or emitted from the hotter plate to the cooler one. When the plates are connected to an external load, the electrons are conducted off to accomplish useful work.

Temperature Limits Load

Load is limited by the temperatures of the anode and cathode, by the materials used for these, and by the distance of separation. In preliminary tests the cathode and anode have been made from tungsten impregnated with barium-strontium carbonate. The cathode and anode were cylinders about ⅛-in. in diameter. Each cylinder was hollow and carefully fitted with a separate internal electric heater so that the functions of the cathode and anode could be readily interchanged. The diameter of the electron emissive surface was approximately ⅛ in.

A potential of about 1 volt per set of plates is delivered. It is hoped that within two years units of from 100 to 500 watts or more may be developed. Units can be connected in series to give higher voltages. Radioactive isotopes may be used to facilitate plate heating. Heat from the combustion gas of a rocket engine might also be used if heat exchange equipment is provided.

On the basis of the current model a relatively efficient power plant can be built to yield 5,000 to 15,000 watts per cu ft of total plant volume with a probable thermal efficiency of over 10%. Principal application of the equipment will probably be in the satellites, missiles and airborne auxiliary power systems. But Dr. Hatsopoulos believes that such equipment may also have early competitive advantage over conventional systems in small power plants.

TRANSMISSION
Equipment News
DISTRIBUTION

Now Is the Time to Identify Values

by **D. K. BLAKE**

D. K. BLAKE, widely known engineer, economist and editor, is the Economic Consultant to User Industry Sales, General Electric Company.

Now is a good time to revive some of those studies and projects that were laid aside because management needed its available money for generation and major transmission expenditures. Distribution had to wait, for it could always be made to work after a fashion.

Once given the appropriations for these projects, it is of the utmost importance for you to guide your purchasing management so they can fulfill their obligation to get the most value for your company's money. Now, value has two definite, and distinct aspects. The first is *Value-in-use*. Your company buys "usefulness" or "utility." No more and no less. This *Value-in-use* is supreme. The second aspect of value is *Value-in-exchange*—the dollars you will pay in exchange for such usefulness.

A product having added value in the sense of added utility or added usefulness gives the greatest *Value-in-exchange* when your suppliers' prices are the same. Comparison, therefore, is essential in order to determine the added or marginal usefulness of products which are approved for use on your system. You, the user, must make this comparison for your purchasing manager. He is not in a good position to know the usefulness of features claimed by suppliers. Your buyer is in danger of thinking that the products of all suppliers on the so-called approved list have equal usefulness. He may, therefore, exercise his choice on some grounds other than *Value-in-use*, and consequently not get his best product *Value-in-exchange* for a dollar. To that extent he fails in his desire to make his purchases count the most in contributing to the profitability of your company. Therefore, he must rely on you, the actual user, to give him this comparative information so he can make a sound purchasing decision.

Our sales engineers, product specialists and application engineers will welcome your request to compare our products' worth in added *Value-in-use* to your company.

OPERATION up turn
GENERAL ELECTRIC

Now is the time to buy for extra values . . .

an EXTRA VALUE product feature

OPERATION upturn
Buy now for extra values
GENERAL ELECTRIC

1-ϕ 250-kva on the pole

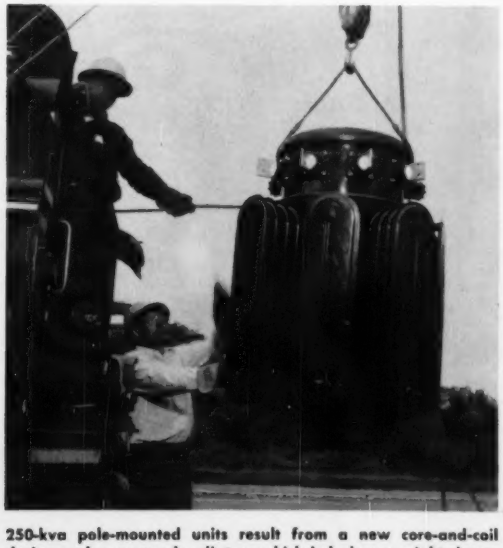
1750-pound unit gives extra value where space is at a premium

This completely new pole-type transformer is solving many location problems in crowded urban areas. Small size, light weight and improved electrical characteristics result from basic design improvements. New radiators and a new core-and-coil design, for example, help keep weight down, performance high.

No unusual equipment is needed to install the new 250-kva units.

They are equipped with Type C support lugs, oil-drain plug and sampling device, liquid-level marking, and internally operated tap changer.

For operating characteristics and delivery schedules, call your nearby G-E Sales Office.



250-kva pole-mounted units result from a new core-and-coil design and new panel radiators which help keep weight down.

3-ϕ 225-kva on the pole

Cut installation costs, solve location problems with 2500-pound pole-type units

Substation transformer ratings, on the pole, mean money saved in initial investment and installation costs to users of these new lightweight G-E transformers.

The large reduction in pounds per kva of capacity is due to a unique design of core and coils and the use of improved magnetic steel. With substation capacity now available in pole-mounted units, many location problems in crowded areas are solved with major savings in construction and installation costs.

The new lightweight transformers shown in the photos are rated 225 kva, 4160 volt, 3 phase. For complete information, contact your nearby General Electric Sales Office, or write to General Electric Co., Section 431-76, Schenectady 5, N.Y.

GENERAL ELECTRIC

Crowded locations are readily served with G.E.'s new 225-kva pole-mounted transformers. 3-phase units weigh 2500 pounds.

*Implications of the New "Evans" Core**

HAROLD BRUNTON, JR.

Manager—Network Transformer Sales

It has been said that many important developments are remarkably simple in their concept. Certainly this is true with the new "Evans" core, which is a major design advance and yet fundamentally straightforward.

Designers have considered using a wound core for network transformers ever since 1937 when G.E. introduced a spirally wound distribution transformer core using cold-rolled strip steel. However, large transformer ratings and three-phase units presented complex design and manufacturing problems. Tom Evans solved these problems by using two wound cores and then winding a third core around the other two.

Straightforward as this approach seems, to put it into practice required years of development, including new materials, new design techniques and the use of new manufacturing methods. One by one these individual problem areas were conquered.

The designers were continually faced with the fact that network transformers must meet more stringent requirements than most other transformers.

Short-circuit strength must be higher because of network system characteristics. Losses must be lower to minimize heating because the units are usually installed in small confining spaces. Corrosion resistance must be greater because the units are often completely flooded by contaminating liquids.

We believe that a remarkable reduction in size is made in the new "Vaultmaster" network transformer. Even more remarkable is that it was accomplished without sacrificing any of the other characteristics which have long been offered by G-E network transformers. In fact, further improvements have been made in many of these characteristics. We believe, therefore, that the "Evans" core definitely means ***extra values*** for our customers.

*Named after its originator, T. M. Evans, a G-E transformer design engineer.

New Core, New Radiators, New Thermal Design in "Vaultmaster" Networks

Smaller, lighter transformers simplify installation and maintenance

The new G-E "Vaultmaster" design represents important advantages for network users. Smaller transformer size can mean less expensive vaults, easier installation, and often increased kva capacity for existing vaults. For example, a new 750-kva unit is about the same size as the former 500 kva. Three innovations make the smaller size possible.

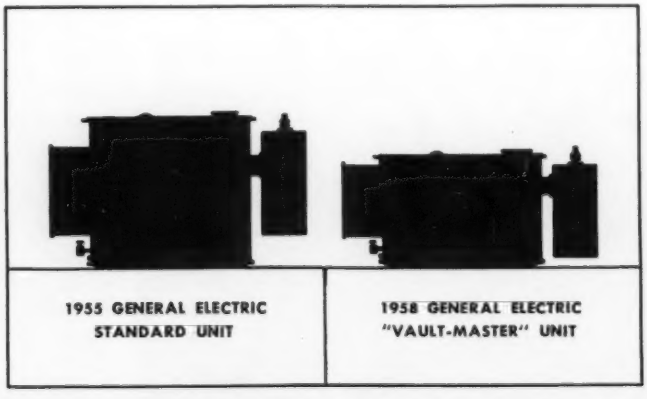
The "Evans" core is a new design which makes it possible to use the famous G-E Spirakore† core construction on large three-phase units. This core utilizes the grain-oriented cold-rolled strip steel to its best advantage, resulting in smaller core and coil size and improved characteristics.

Panel radiators provide a tremendous amount of heat dissipation in a small space. In addition, this radiator design cuts down the number of tank openings and gives a smooth, uncluttered surface that is easy to keep clean.

Balanced thermal design is the new G-E approach to winding design which balances the thermal increments to provide the maximum of overload capacity. Facilitated by the extensive use of computers, the new winding design also increases reliability.

†Registered trade-mark of General Electric Co.

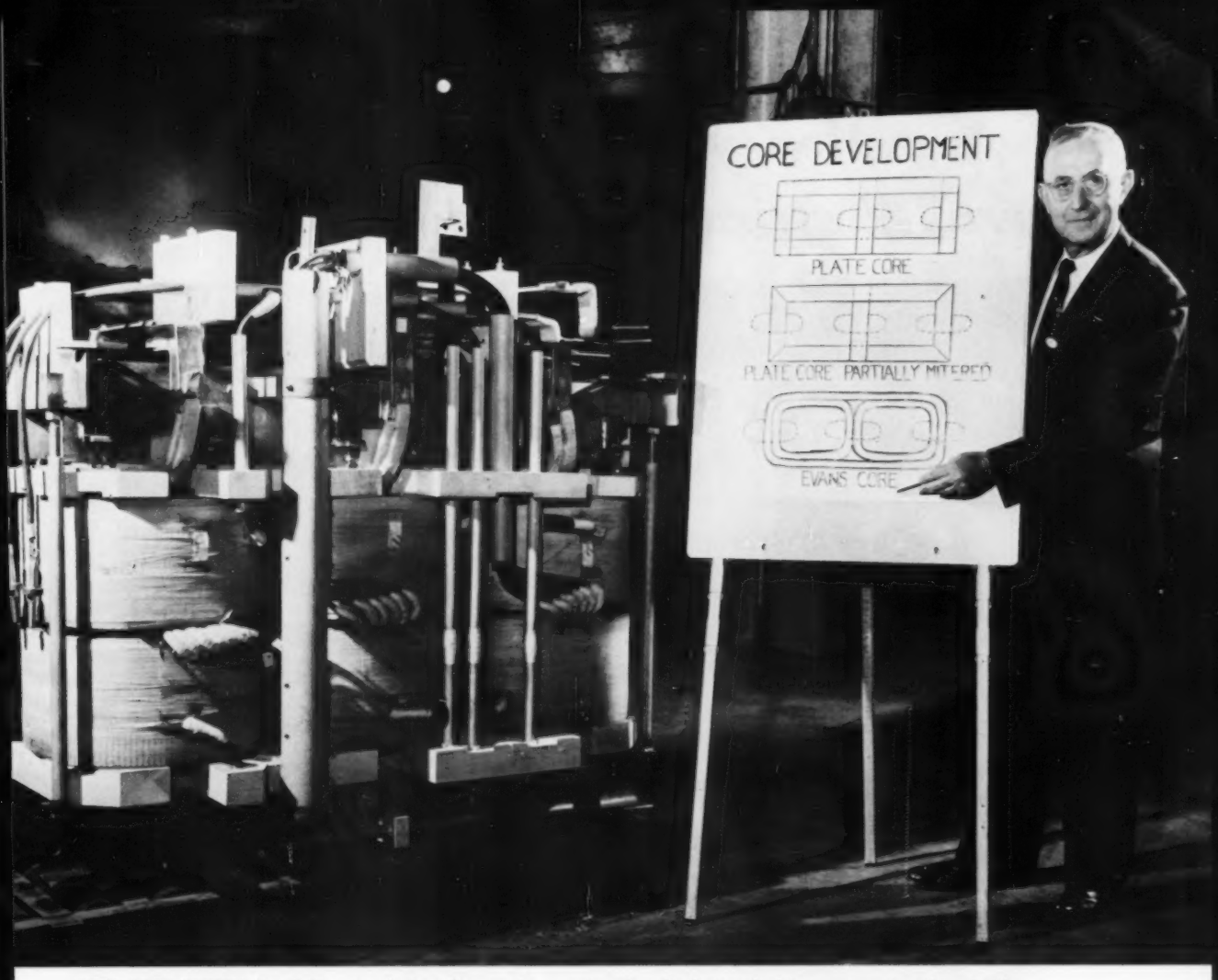
DRAMATIC SIZE REDUCTION IS EXTRA VALUE



VAULTMASTER SAVES ON FUTURE CHANGES with its new low height. There is ample space for addition of higher-rated units or oil-fuse cutouts or capacitors. Smaller size gives "elbow room" for easier maintenance.

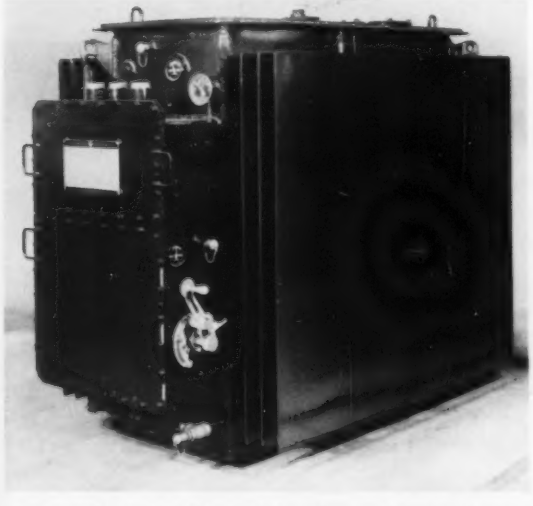
an EXTRA VALUE product feature

OPERATION upturn — GENERAL ELECTRIC



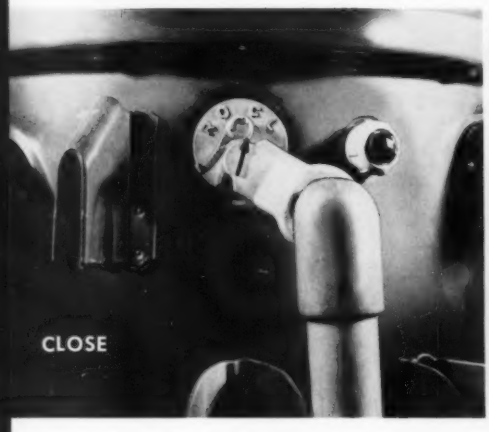
NEW CORE DESIGN for G-E network transformers is shown by its originator, T. M. Evans. Chart shows evolution of core design from 1955 when all standard network units featured plate-core construction. At the left is a new 750-kva core and coil unit, featuring the Evans design which means smaller, lighter transformers.

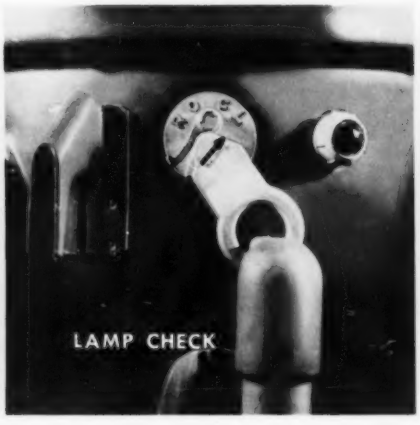
BALANCED THERMAL DESIGN tests prove even, controlled heating, reduced hottest-spot temperatures, resulting in extra-long transformer life and increased loading.

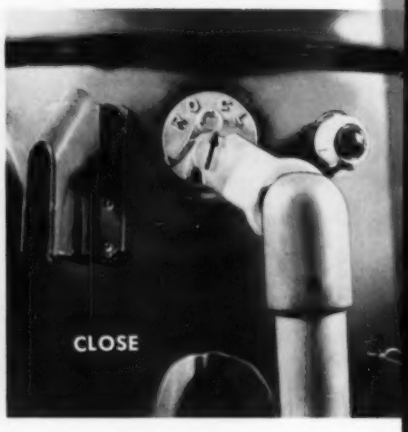


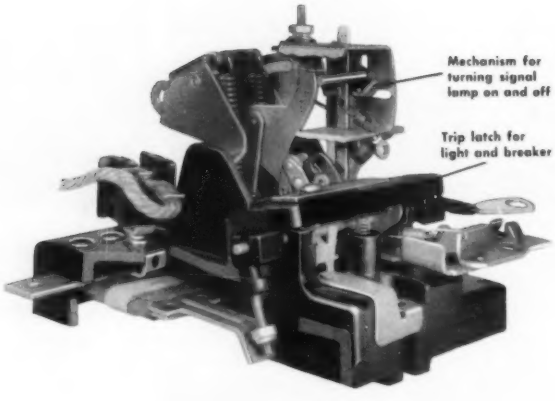
G.E.'S PANEL RADIATORS increase reliability since there is less chance for leaks with only eight entrances to tank. Smooth panels are easy to keep clean on these units.

Two New Money-Saving Extra Values with General Electric Distribution Transformers









Every G-E breaker lamp now checked easily without removal from transformer

This convenient lamp-test provision is now available on all General Electric self-protected transformers. The sequence photos above show how the lineman can check the lamp quickly, without removing it from the tank. This provision has been added to the AHT-1 breaker (at left), which is used on units below 37½ kva rating. The G-E T-2 breaker—for units 37½ kva and above—has the same lamp-test feature.

Bushing keyed to tank cover won't turn as lineman tightens connection

Linemen like this added value feature of G-E distribution transformers. Terminal bolts can now be tightened with a one-hand operation since in addition to keying the terminal bolt to the bushing, G.E. now keys the bushing to the tank cover as well. Thus, the bushing will not rotate in the cover seat when the lineman tightens the terminal bolt.

GENERAL ELECTRIC

OPERATION up turn — Buy now for extra values — GENERAL ELECTRIC

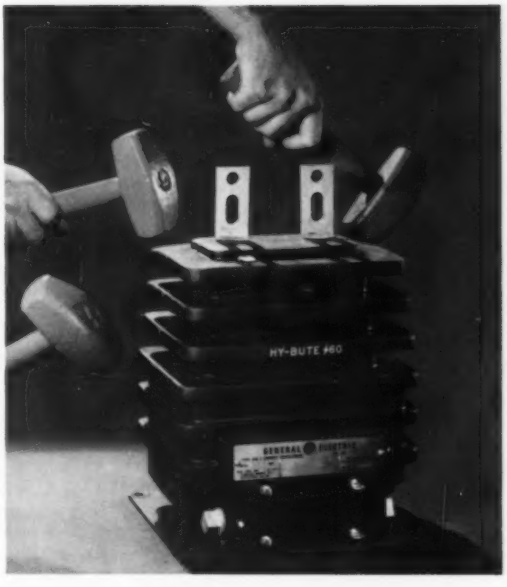
NOW Extra Values of Tough BUTYL . . .

. . . in 15 types of instrument transformers

Being tough, butyl supplies a lot of extra values to G-E instrument transformers. Some of these values are: longer life, safer operation, easier handling, simpler installation, and reduced maintenance.

On top of that, you'll get a certificate with each unit that certifies the transformer has passed insulation and accuracy tests.

The butyl family has been growing steadily. It now has 15 types. Current transformers completely cover the range from 600 volts to 15,000 volts, for indoor and outdoor service. And, potential transformers are now available for 5,000-volt service, both indoor and outdoor.



TELEMETERING

EXTRAS . . . in new equipment for 5–15 Cy per Sec

Now you can get a system that will transmit signals over low-cost channels. It's made possible by General Electric's new equipment for operation at only 5–15 cycles per second.

More than that, we can furnish a completely coordinated system, including a new wide-chart potentiometric recorder—all nicely packaged* on a panel or in a cubicle.

If you've been postponing telemetering because of high-cost transmission, give us an opportunity to quote on our new 5–15 cps.

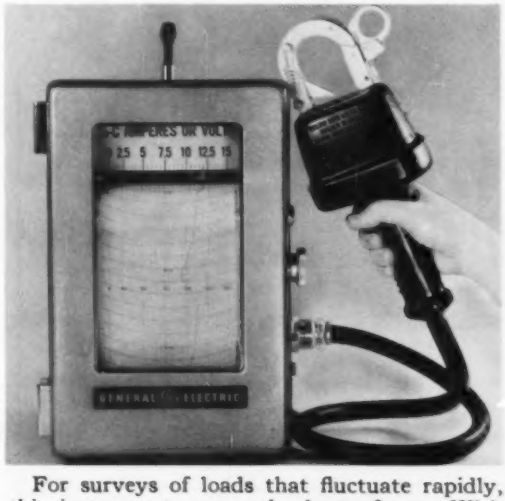
**Our ability to furnish the customer with completely packaged systems recently influenced two utilities to purchase General Electric telemetering systems.*

Also for Utilities

- **Switchboard Indicating Instruments**
- **Switchboard Recording Instruments**
- **Portable Indicating Instruments**
- **Portable Recording Instruments**
- **Automatic Dispatching Systems**
- **Leak Detectors (three types)**
- **Turbine Supervisory Instruments**
- **Reactor Instrumentation**
- **Automatic Time Switches**
- **Automatic Oscillographs**
- **A variety of Specialty Instruments**

NEW RECORDER FOR LOAD SURVEYS

Type CH-7



For surveys of loads that fluctuate rapidly, this instrument serves the best of any. With continuous inking, it responds fast and makes sharp, clear lines. With a spring-driven chart drive, it can be installed miles from nowhere. And, look, it just clamps on the line. Versatile, too; it has 6 current ranges—15, 30, 75, 150, 300, and 750 amperes.

In addition, you can also use it as a voltmeter. Ranges: 150/300/750 volts.

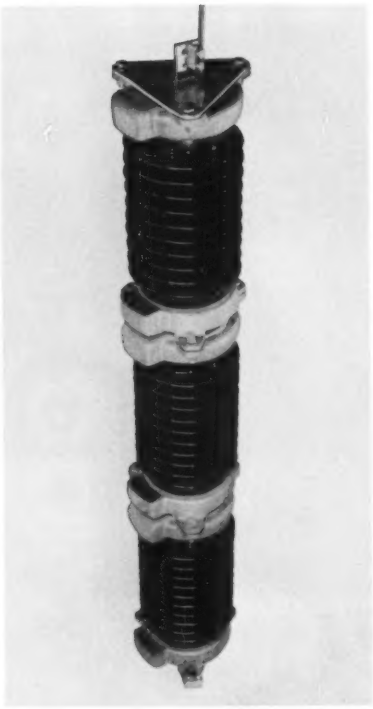
Consider, too, all the advantages of the CH recorder: throw-away inkwell, 60-day spring clock, two-month record rolls, and 28 possible chart speeds.

an EXTRA VALUE product feature

OPERATION up turn — Buy now for extra values — GENERAL ELECTRIC

Buy now—the new Form 3K arrester with

1000-Amp Long-Duration Discharge Capacity



The new G-E Form 3K station-class arrester helps your system meet the rapid changes coming in the next decade and provides premium operating characteristics at today's standard price levels. G.E.'s proven Magne-valve principle gives the 3K a 1000-ampere long-duration discharge capacity 570% greater than industry standards, and an improvement of 54% over G.E.'s popular Form 1H arrester. You can confidently adopt the Form 3K for use with two-step reduced BIL insulation for lightning currents in excess of 30,000 amperes through the arrester. Full operating and installation information is available at your General Electric Sales Office.

Revolutionary gap design has no coils or magnets

An extra-capacity Thyrite* valve ring is the key to the Form 3K arrester's long-duration discharge capacity. This Magne-valve action is shown in the diagrams below and occurs in this sequence:

1. GRADING CURRENT

Under normal voltage conditions, Thyrite gap shunting resistor gives uniform voltage distribution across entire stack.

2. IMPULSE CURRENT

Lightning and switching surges jump main gap and discharge to ground through Thyrite valve element. Pre-ionizer gives uniform sparkover.

3. INITIAL POWER FOLLOW CURRENT

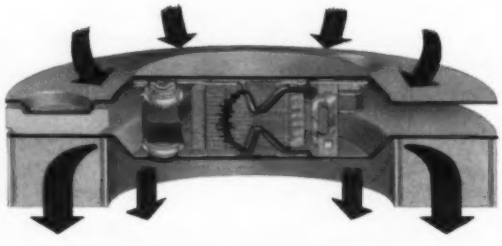
The magnitude of the power frequency follow current is limited by resistance of Thyrite elements. Gaps begin to extinguish current.

4. POWER FOLLOW CURRENT INTERRUPTION

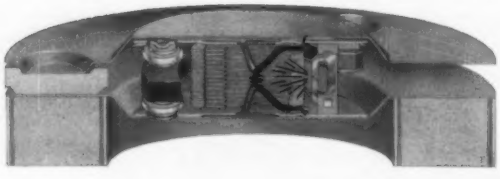
Arc moves toward free end of horn gap, reinforced by flux action in auxiliary plates, breaking into 15 separate arcs.

*Reg. Tradename of G.E. CO.

1. GRADING CURRENT



3. INITIAL POWER FOLLOW CURRENT



2. IMPULSE CURRENT

4. POWER FOLLOW CURRENT

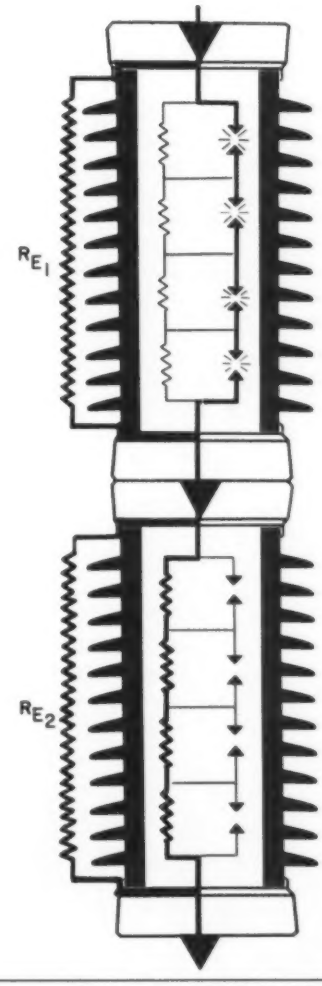


Fig. 1. Conventional Arrester

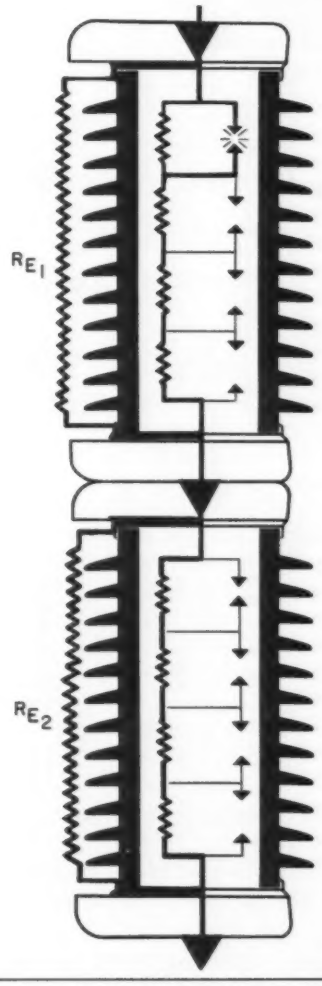


Fig. 2. G-E Form 3K Arrester

Anti-contamination Design

When arrester porcelain is contaminated, leakage current increases over the external path (R_E in figures above). Resistance drops on the wet surface, rises as it dries. Uneven drying causes an uneven voltage gradient over the stack. In ordinary arresters, internal gaps are evenly spaced. When one sparks, others on that unit follow, removing this unit from service, as shown in Fig. 1 above. If uneven drying continues to cause arrester sparkover, this could lead to a runaway condition resulting in arrester failure.

The new G-E Form 3K station arrester overcomes this fault with graded gap spacings. When contamination causes the voltage to jump the smallest gap, the others, having greater spacing, remain in service as shown in Fig. 2. The unit's resistance then more nearly matches the others, restoring uniform voltage distribution.

Burn-through pressure relief diaphragms, exclusive with G-E arresters, provide safe operation in the remote event of failure. Top and bottom apertures vent hot, pressurized gasses and form an external conducting path.

Ask for complete details on the Form 3K station arrester at your General Electric Sales Office, or write General Electric Co., 431-76, Schenectady 5, N. Y.

OPERATION up turn
Buy now for extra values
GENERAL ELECTRIC

GENERAL ELECTRIC

an EXTRA VALUE product feature

OPERATION up turn — Buy now for extra values — GENERAL ELECTRIC

NOW IS THE TIME

How General Electric capacitors can pay for themselves by reducing your operating costs

You can expect a 25 to 45% annual return on your investment when you buy General Electric power capacitors*. G-E capacitors can pay for themselves within two to four years, and can go on producing savings year after year after year. Such a high return on investment is possible because 50-Kvar units are now priced as low as $3.11 per Kvar, with switched capacitor equipments as low as $4.15 per Kvar. As a result, capacitors are now a more economical source of kilovars than ever before, especially in view of the high cost of generating and transmitting this commodity from your power stations.

Capacitors you add to your system can:

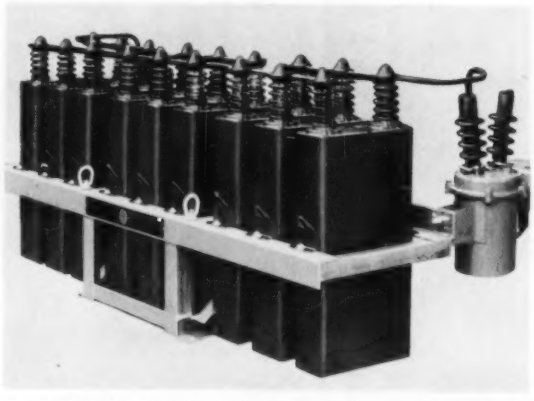
1. REDUCE KILOWATT-HOUR LOSSES. On a system operating at 90% power factor, you can expect each 50-Kvar capacitor located in the distribution area to eliminate 8500 Kw-hrs. in losses per year.

2. IMPROVE SYSTEM VOLTAGE LEVEL and allow more KW load to be served. Generally, over one-half of system voltage drop is caused by kilovar flow. Engineering studies show that, from a voltage-drop standpoint, system loading can be increased one KW for each Kvar installed in the load area.

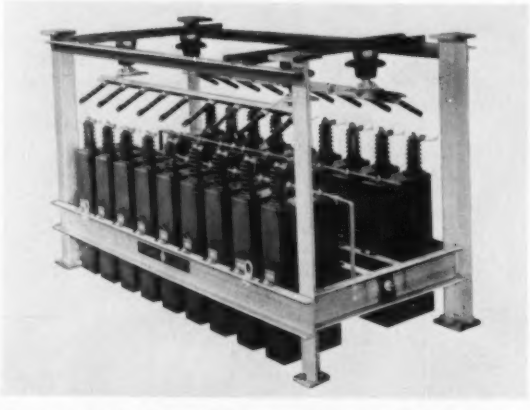
3. RELEASE THERMAL CAPACITY. By eliminating kilovar flow through transformers and other thermally limited equipment, capacitors will allow you to serve more pay load with existing equipment. For example, capacitors added to a system operating at 90% power factor will release nearly 20 KVA of thermal capacity per Kvar capacitor.

To begin producing these savings immediately; to help you handle present and future loads more economically; and to get extra value from your investment, now is the time to buy General Electric power capacitors. Contact your General Elec tric Apparatus Sales Engineer or write to Section 431-76, General Electric Co., Schenectady 5, N. Y.

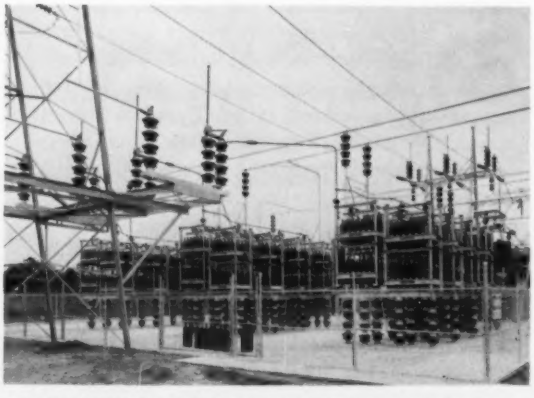
** Ask your General Electric Apparatus Sales engineer to show you the investment return capacitors can produce on your system.*



1. CORROSION-RESISTANT ALUMINUM RACKS provide their own protective coating. The framework of G-E open rack capacitor equipment like that of this pole-top bank will not require painting, even in the corrosive atmospheres of industrial or coastal areas. Accessories can be added in the field by simply drilling or tapping the aluminum frame; no protective touch-up is necessary.



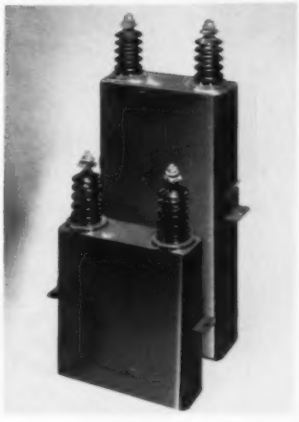
2. FAST, EASY INSTALLATION is possible with General Electric's complete line of factory-assembled capacitor equipments. Corrosion-resistant capacitors, fuse-holders and buswork have been pre-assembled in this lightweight aluminum stack rack to reduce your installation time and costs, thus giving you extra values.

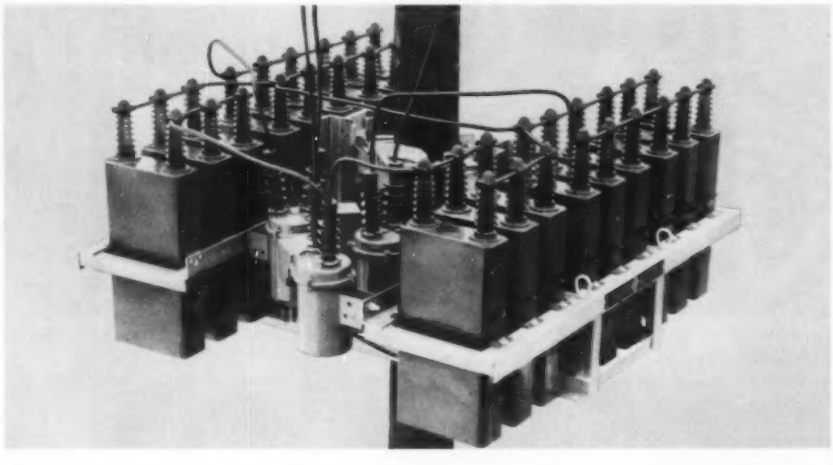


3. ENGINEERING SERVICES CONTRIBUTE EXTRA VALUE in every purchase of General Electric power capacitors. General Electric helped solve a customer's system problem by designing this high-voltage series capacitor installation. The tailor-made installation provides an economical balance of power flow over parallel lines.

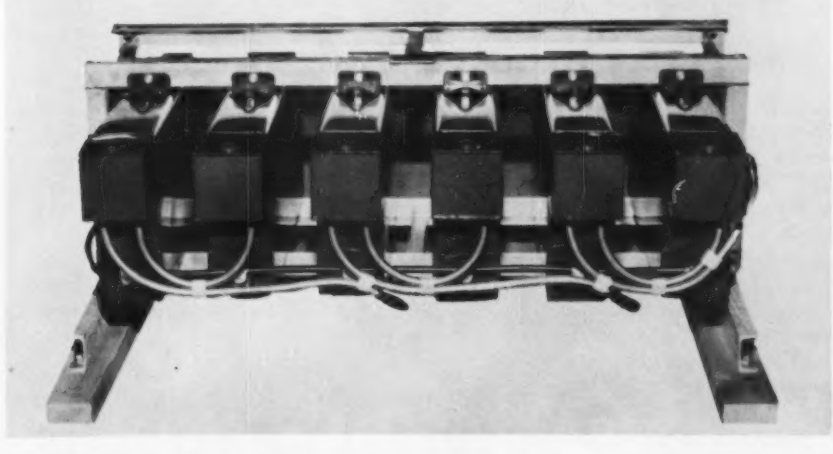
Seven Extra Features in Capacitor Equipment Help Reduce Maintenance and Improve Service

Ask your General Electric apparatus salesman for complete details on these extra features





4. NEW POLE-TOP CAPACITOR EQUIPMENT IS BALANCED, EASY TO INSTALL. For larger capacitor banks on distribution feeders, a new G-E cluster-type, pole-top capacitor equipment is now available in ratings as high as 1200 Kvars. Perfect balance of this equipment means there is practically no bending moment on pole. It's quick and easy to install—a compression-type bracket squeezes the pole, eliminating the need for drilling and bolting. FKC oil switches can be located close to pole, in easy reaching distance for linemen. Structural material of corrosion-resistant aluminum is lightweight and requires no maintenance.



5. UNDERGROUND ENCLOSED CAPACITORS RESIST SUBMERSION. To help provide capacitor kilovars where there is no available pole space on an overhead system, or for entire systems underground General Electric developed this primary equipment for installation in vaults or man-holes subject to submersion. It is also ideal for surface applications in contaminated atmospheres where exposed bushings would become coated with conducting materials, or where clearances from live parts to buildings or personnel would not be adequate as with some other types of conventional capacitor equipment.

6. VIRTUALLY NO PAINT MAINTENANCE is required on General Electric power capacitors. The tough, corrosion-resistant case of these 50 and 25 Kvar units, and that of residential secondary capacitors, too, withstands rain, snow, salt-fog and contaminated atmospheres, and will not require protective repainting. To prove the durability of G-E capacitor case material, it was subjected to a salt-fog test in the General Electric Capacitor Department's Advance Materials and Development Laboratory. After 4768 hours, it showed not the least trace of corrosion or rust.

7. NEW SERIES CAPACITOR AIDS TRANSFORMER UTILIZATION. Increased loading of your distribution transformers is possible with this new low-voltage series equipment. Consisting of a secondary capacitor and protective gap, this equipment makes a distribution transformer virtually self-regulating. The gap, which prevents excessive voltages from occurring on the capacitor and transformer, removes the capacitor from the system under abnormal voltage conditions, and re-inserts it when normal voltage is restored. The corrosion-resistant capacitor case, stainless steel gap and alumina ceramic bushing and insulator contribute to the long, useful life of this secondary series capacitor equipment.

40,000-KVA, 230-KV MOBILE TRANSFORMER is latest evidence of General Electric progress in increasing mobile capacity while holding the line on size and weight. General Electric mobile equipment, used for maintenance or reserve capacity or to serve temporary or peak loads, means important savings in system operating costs. Many utilities are finding that larger ratings are providing ever larger savings.

PROGRESS IN G-E POWER TRANSFORMERS THAT PAYS OFF . . .

Mobile Transformer Rated 40,000 kva

Many utilities benefit with new higher-rated mobile substations and transformers as General Electric holds the line on size and weight

General Electric has spearheaded a major advance in the design and manufacture of mobile substations and transformers in the past few years. Only recently 5000 kva was considered huge for this apparatus. This year, in the 7500- to 40,000-kva range, G.E. has built or is actively working on more than a dozen mobile substations and transformers!

Innovations now in development will mean that this trend to higher ratings can continue for years without exceeding highway limiting dimensions. A better understanding of weight problems between the utilities and state and local authorities will also contribute to the wider application of mobile apparatus.

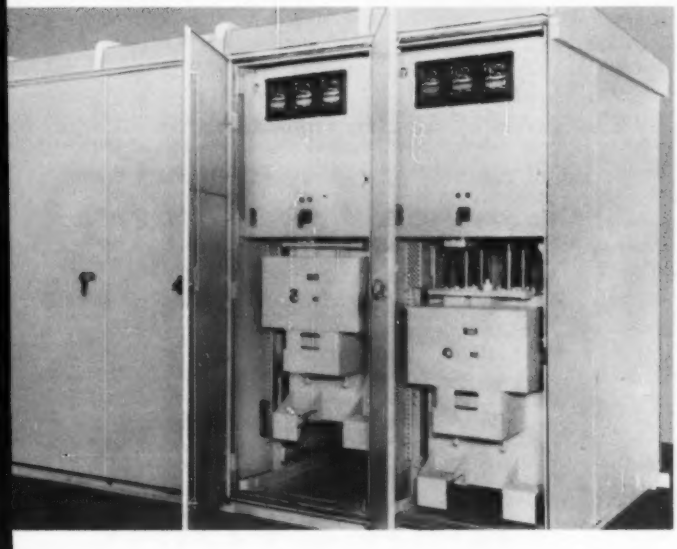
Mobiles are being used more and more as maintenance tools, as reserve capacity, and as a means of serving temporary or peak loads. The new, higher-rated G-E mobile subs and transformers magnify these areas of savings for utilities.

For information on how G-E mobile apparatus can help improve your system operating economy, contact your G-E Apparatus Sales Office, or write Section 431-76, General Electric Co., Schenectady, N. Y.

GENERAL ELECTRIC

OPERATION upturn
Buy now for extra values
GENERAL ELECTRIC

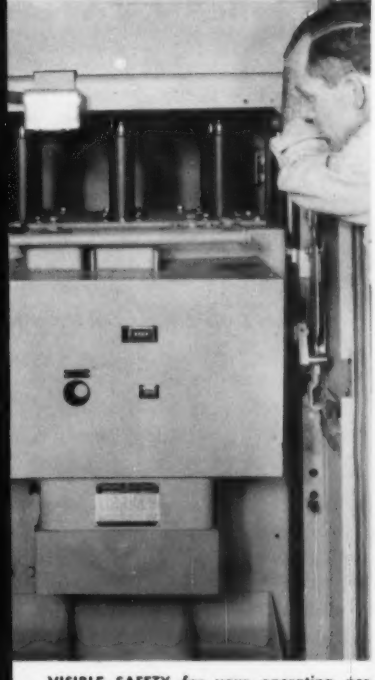
Creative Design Engineering Puts Extra Values in General Electric Metal-Clad Switchgear



A new design for General Electric's outdoor metal-clad switchgear typifies the engineering creativity which means extra values for you. Design resourcefulness now brings you these extra values in outdoor metal-clad:

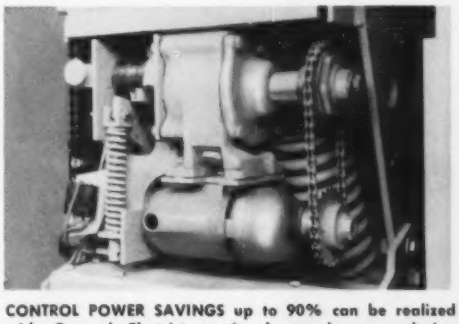
- **ONE-MAN OPERATION** and maintenance—all operations are conducted from the front of the switchgear, since control and protective devices are panel-mounted above the breaker.
- **SMALLER FOUNDATION SIZE**—rear aisle is eliminated, pad size reduced.
- **SIMPLIFIED FOUNDATION CONSTRUCTION**—power conduit need not be imbedded in pad.
- **EASIER INSTALLATION**—no skidding of switchgear over stubbed power conduit in foundation.
- **ALL-WEATHER MAINTENANCE**—a protected aisle is optionally available to shield your maintenance crew from inclement weather.

After checking these, and the other extra values on this page, call your General Electric Apparatus Sales Engineer for the details.

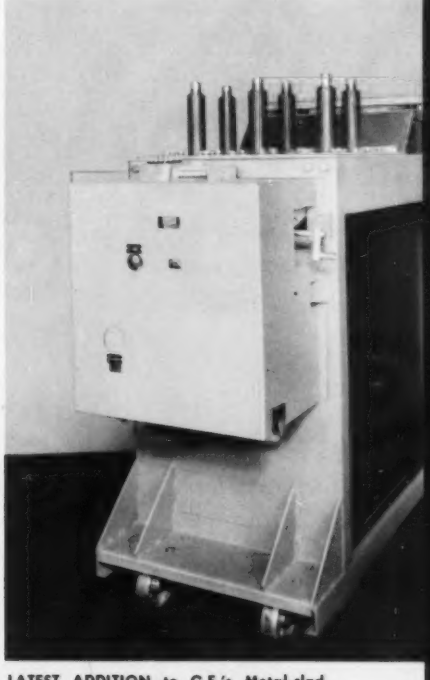


VISIBLE SAFETY for your operating personnel is a product of G.E.'s unique vertical-lift design. Operator actually sees when contacts part, and lower center of gravity cuts danger of breaker tripping.

FLAME RETARDANT SELF-X insulation, which will not support combustion and extinguishes itself almost immediately, is typical of G-E insulation advances.



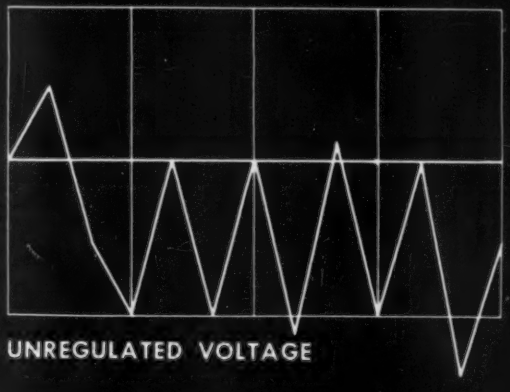
CONTROL POWER SAVINGS up to 90% can be realized with General Electric's optional stored-energy closing device. Another extra value—quicker, safer, manual operation and re-charging in the event of control power failure—more examples of creative design engineering.



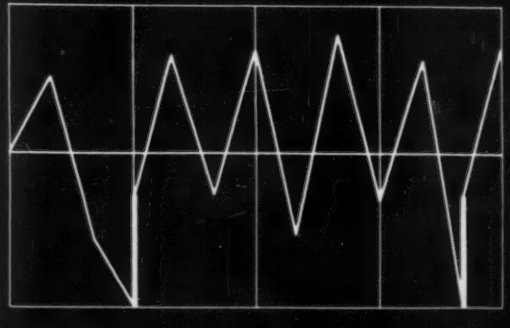
LATEST ADDITION to G.E.'s Metal-clad Switchgear line is the 1000-mva breaker. Complete line now includes ratings 2.4 to 13.8 kv and 75 to 1000 mva, and two-cycle interruption at 4.16 and 13.8 kv.

an **EXTRA VALUE** product feature

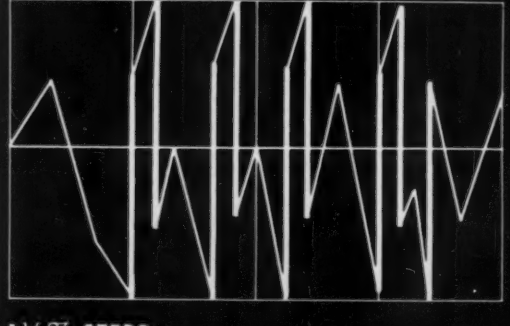
OPERATION up turn — Buy now for extra values — GENERAL ELECTRIC



UNREGULATED VOLTAGE



5/8% STEPS

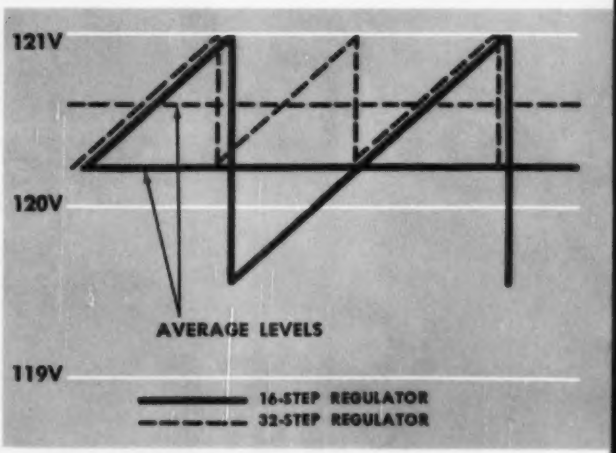


1¼% STEPS

The value of 32-step regulators

In actual practice, 32-step regulation offers the optimum *combination* of economy and well-regulated voltage. Here's why . . .

32-STEP REGULATION MEANS . . . . .



16-STEP ADVOCATES select the profile above to prove fewer operations, better average voltage. This assumes that voltage always changes in same direction. Actually, your system voltage fluctuates up *and* down. Realistic examples at left clearly show the facts. Thick, vertical lines indicate frequency of tap switch action.

32-step regulators provide closer regulation, longer life

32-step regulators on a typical feeder can be set to hold a closer bandwidth (a measure of profit and service) with less problem to the utility. This is true, although bandwidth should always be set greater than the size of the step in order to have stable operation of controls and to avoid hunting. Hence, with the same amount of desirable time tolerances (to avoid unnecessary operation), a narrower bandwidth can always be set on units having a smaller step size.

Even with holding effect, which provides assurance against undue relay contact wear and unnecessary switch operation, General Electric regulator controls can be set to hold a minimum bandwidth of between ± ¾ and ± 1 volt. Because of control accuracy—even Class 1—it is impossible for any 32-step or 16-step regulator to hold a true ± ¾-volt tolerance *on the line*. It is highly improbable that field adjustment of 16-step regulators will result in a 2- or even 3-volt tolerance *on the line* because of normal control and human inaccuracies imposed upon a 1½-volt step.

By noting the conditions common to many systems (the three charts at the left), the superiority of 32-step regulation may be seen in terms of reduced operation on average, not "selected" feeders.

The G-E ML-32 need not be untanked for inspection until after the prescribed number of operations—normally covering 20 years or more. One reason: smaller tap voltages mean less electrical wear (contact erosion) per tap change because contact erosion is approximately proportional to tap voltage. Physical wear, on the other hand, has been proven to be relatively insignificant—by test and actual field practice. Five-eighths per cent steps on the ML-32 result in less rupture voltage.

The G-E ML-32 will operate successfully under short circuits of 25 times normal *during* tap changes at any Load Bonus position. Tip life is co-ordinated with the insulation so that the oil does not have to be serviced during the life of the contacts.

Your G-E sales engineer has complete details on why G-E 32-step regulators cost less on the line. General Electric Co., Schenectady, N. Y.

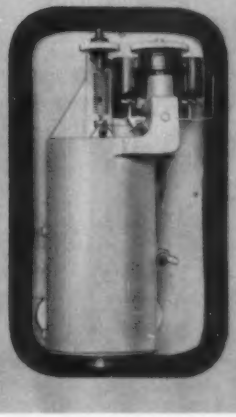
423-28

Progress Is Our Most Important Product

GENERAL ELECTRIC

. *General Electric regulators cost less on the line*

ML-32 VRR WILL HOLD ± ¾ V BAND

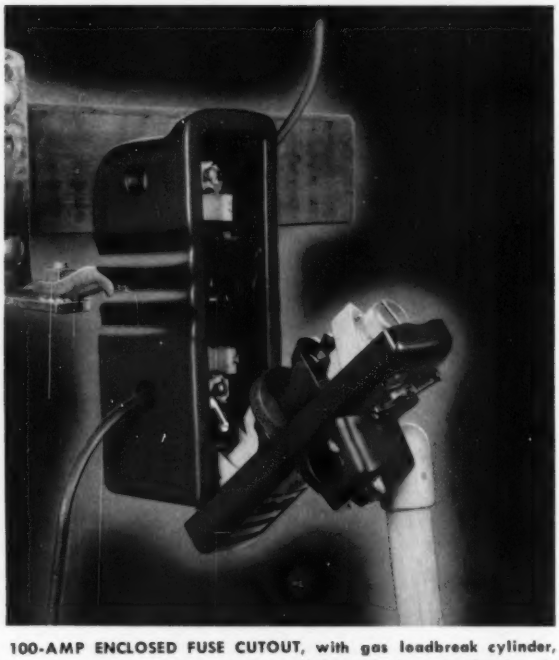


CLOSER BANDWIDTH means savings in system operation. With the 32-step regulator, a 1½-volt band is easily set and because of time tolerances will be maintained at 2 volts or less. Attempts to hold 2 volts with a 16-step regulator could result in endless hunting.

ML-32 TDR ADJUSTABLE FROM 10–120 SECONDS

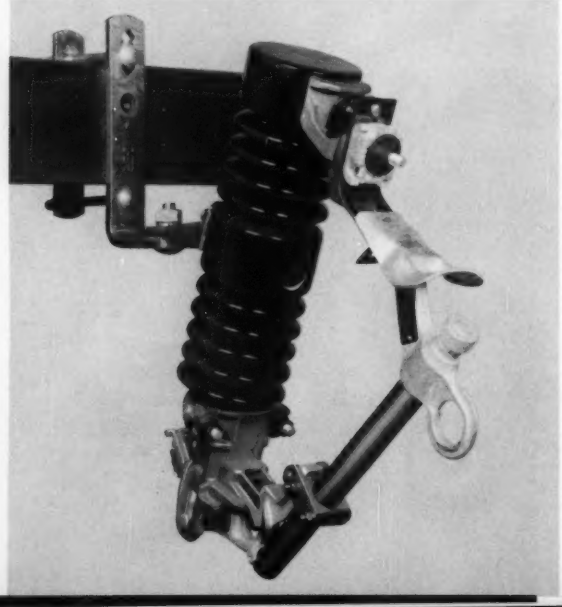
TIME DELAYS of 30 seconds are preferred by most utilities. ML-32 integrated time delay can be set *as desired* for a wide range of time delays (10-120 sec.). Result: Greater ease of control adjustment, greater operating economy, and a better *balanced* job of voltage regulation.

Extra Value in Enclosed and Open Dropout Cutouts



100-AMP ENCLOSED FUSE CUTOUT, with gas loadbreak cylinder, can now replace more expensive switching devices. As the door is opened, a high-pressure blast of insulating gas automatically extinguishes a full-load power-current arc in 3 to 7 cycles. Replacing the used cylinder is simple and can be done on the pole in moments.

10,000-AMP INTERRUPTION rating at 7.8 kv, and 8,000 amperes at 15 kv extends the usefulness of this new G-E extra-heavy-duty open dropout cutout. Double venting action of fuse tube clears high currents through expendable cap at tube top and normal venting at bottom. Low currents are cleared through optimum bore size and venting fuse tube at bottom only. Full information on the economies of cutouts are available at your General Electric Sales Office.



Free Publications on Transmission and Distribution Equipment with New Extra Values

DISTRIBUTION TRANSFORMERS

10 Reasons Why General Electric Is Your Best Transformer Buy—GEA-6070C.
Self-protected Distribution Transformers—GEA-6126B.

INSTRUMENTS

New Butyl-molded Potential Transformers—GEA-6810.
Telemetering Systems—GEA-5233.
General Purpose Recorder—GEC-1319.

LIGHTNING ARRESTERS AND CUTOUTS

New Form 3K Station Arrester—GEA-6794.
Secondary Lightning Arresters—GEA-2977E.
Open Dropout Fuse Cutouts—GEA-1816L.
Flip Open Fuse Cutouts—GEA-4224E.

CAPACITORS

Power Capacitors—GEA-6662.
Stack-Rack Capacitor Equipments—GEA-6796.
Pole-Top Auto-Switch Capacitors—GEA-6543.
Fixed Pole-Top Capacitor Equipments—GEA 6657.
Residential Secondary Capacitors—GEA-6670.
Protective Gaps for Positive Protection of Series Capacitors—PT-26.

MEDIUM VOLTAGE SWITCHGEAR

Metal-Clad Switchgear—GEA-5664.

FEEDER VOLTAGE REGULATORS

ML-32 Step Voltage Regulators—GEA-5752.
ML-32 Step Voltage Regulators Application Guide—GED-3468A.

POWER TRANSFORMERS

Mobile Unit Substations and Mobile Transformers—GEA-4415.

Any of the above publications may be had at no cost by writing the General Electric Co., Section 431-76, Schenectady 5, N. Y.

LIVE BETTER ELECTRICALLY

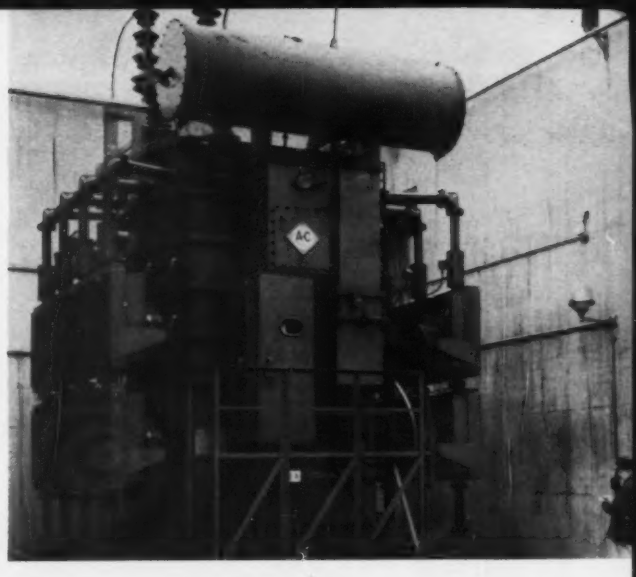
Progress Is Our Most Important Product

GENERAL ELECTRIC

Minimize Fluctuations with Special Design

Negative transformer reactance reduces effect of fluctuating loads upon normal loads served from the same transformer

W. C. SEALEY, Chief Engineer, Transformer and Regulator Depts, Allis-Chalmers Mfg Co, Milwaukee, Wisconsin



Negative-reactance transformer of special design can isolate the effect of proportionately large, fluctuating loads from other loads on the same transformer. Such fluctuating loads, usually of lagging power factor, can be handled at reasonable cost by three or four-winding transformers.

Use of a transformer with a negative-reactance winding must be weighed against use of series capacitors, which are sometimes effective. Another approach, where the supply line voltage drop is small, involves isolation of the fluctuating load from other loads by supplying it from its own transformer. This calls for an additional transformer, which can boost the cost 20-50% more than for a single, full-sized transformer.

By comparison, initial cost of a three-winding transformer is 5% more and a four-winding transformer 7½% more than a two-winding transformer for the same total kva parts, ie, sum of kva ratings of all windings is the same. Where kva parts are increased, the initial cost increases as the ¾ power of the kva parts. For example, a 10% increase in kva parts will raise the initial cost 7½%.

A three-winding transformer of proper design supplied at constant voltage can provide unchanging output voltage on one winding when the load on the other winding changes. It even can provide a voltage rise with increased load on one winding to compensate for a greater supply line drop due to the increased load on the other winding.

Such a three-winding transformer has primary winding H and two secondary windings, A and B, as shown in Fig 1. The equivalent circuit has the power supply between lines H and N, with loads A and B connected to the terminals of windings A and B, respectively. If impedance of H were zero in this circuit, a change in load B would not change the voltage across load A, and vice versa. If reactance of H has a negative value, an increase in load B will increase the voltage on load A, and vice versa.

Reactance of winding H in a transformer with a particular winding cross section (Fig. 1) can be designed to produce a near zero or negative reactance X_H. Typical values of equivalent reactance for the three windings of a medium-

(*Continued on page* 127)

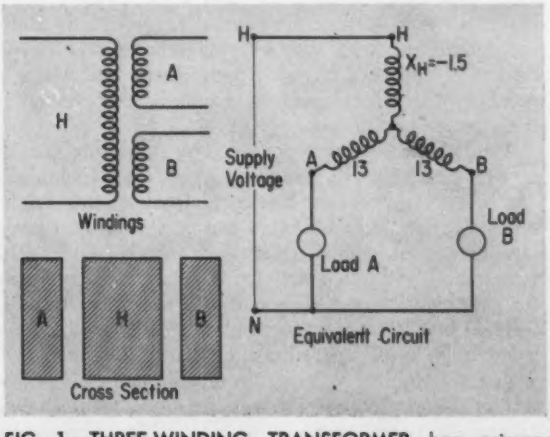


FIG 1—THREE-WINDING TRANSFORMER has primary winding H and two secondary windings A and B. Typical values of reactances are included in the equivalent circuit

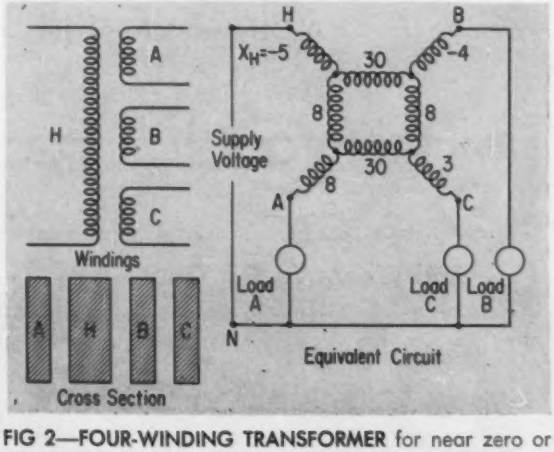
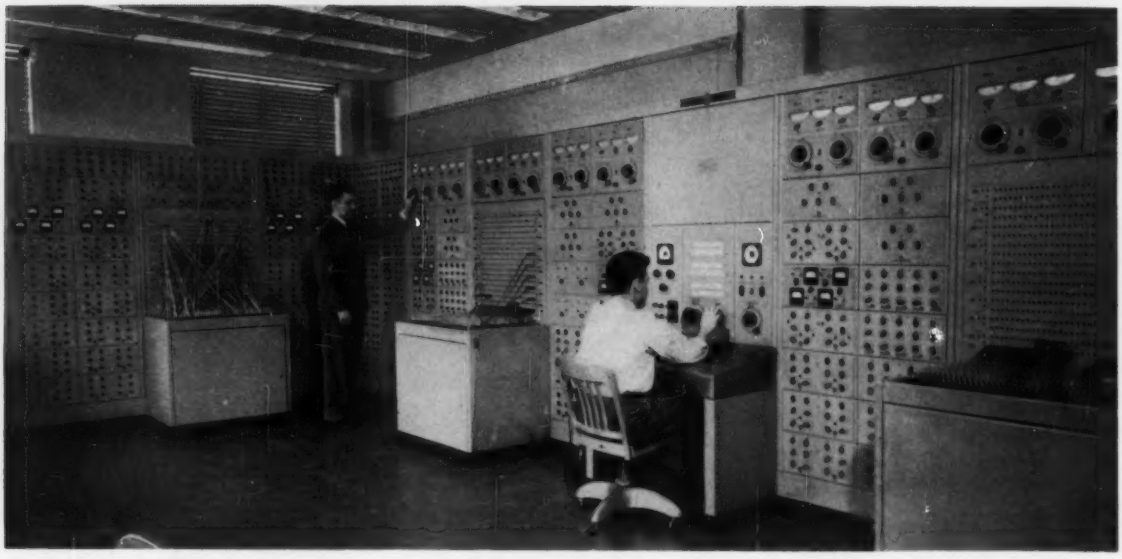


FIG 2—FOUR-WINDING TRANSFORMER for near zero or negative reactance will serve two changing loads and normal load. Typical values of reactance are shown



Industrials Use A-C Network Board

C. C. YOUNG, Transmission & Distribution Analytical Engineering, and

J. DUNKI-JACOBS, Industrial Power Systems Engineering, General Electric Co, Schenectady, N. Y.

As standards of industrial service continuity and reliability become increasingly more stringent, the a-c network analyzer, a time tested utility tool, is finding increasing application in industrial distribution systems. Used in load flow studies, setting up load shedding schedules, calculating interrupting duties, and other types of circuit analyses, it enables the industrial electrical engineer to obtain a much greater volume of information and consider many more alternatives than is economically possible by hand calculations. Unlike the d-c analyzer, it permits use of system impedances with different X/R ratios and is not limited to interrupter and relay application studies. Resistance, inductive reactance, and capacitive reactance can all be represented, to provide data that is not readily obtainable by other methods.

For example, a system load flow study made with this equipment provides a knowledge of bus voltage levels and line current, during both normal and emergency conditions, that enables the industrial electrical engineer to plan system operation and cope with problems arising from expansion or load growth. Although its value in complex configurations is more obvious, it may be economical even in systems consisting entirely of radial lines if there are several tapped loads along the radial line with different magnitudes and power factors at each tap. This is particularly true where a number of different operating conditions or configurations are to be studied.

Voltage dip or flicker produced by starting motors or by loads such as arc furnaces can be readily obtained and investigations of the best corrective measures made. Similarly, the motor load that can be started at a given bus without exceeding a specified voltage dip can be determined. Although estimating charts are available for simple systems, they usually do not allow for distributed loads in the system or for a diversified system using both local generation and a utility supply.

For determining voltage dip magnitude, a simplified system using rated current value of transient reactance to represent generators is a reasonable compromise between an exact representation of the system and estimating charts. The motor being started is represented

When To Use An A-C Network Analyzer . . .

1. Making load flow studies
2. Determining voltage dip or flicker caused by motor starting
3. Setting up load shedding schedules
4. Calculating momentary and interrupting duties for expansions or changes
5. Transient Stability Studies
6. Tracking down unaccountable system disturbances

. . . And Where To Get One

Services of an analyzer and operators may be rented at numerous locations throughout the country. Owners of analyzer facilities include:

1. Educational institutes
2. Manufacturers of electrical equipment
3. Engineering organizations
4. Electric Utilities

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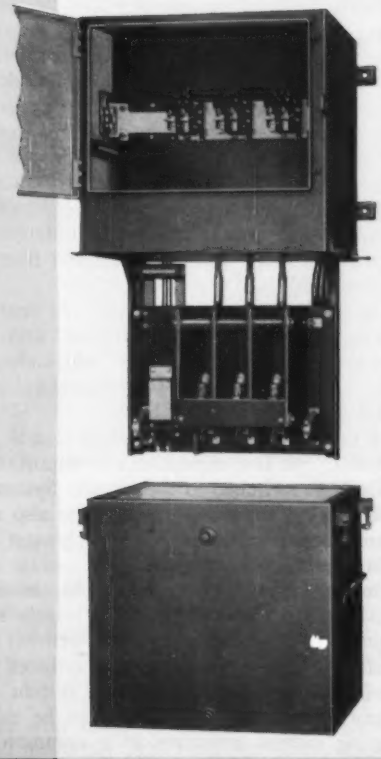

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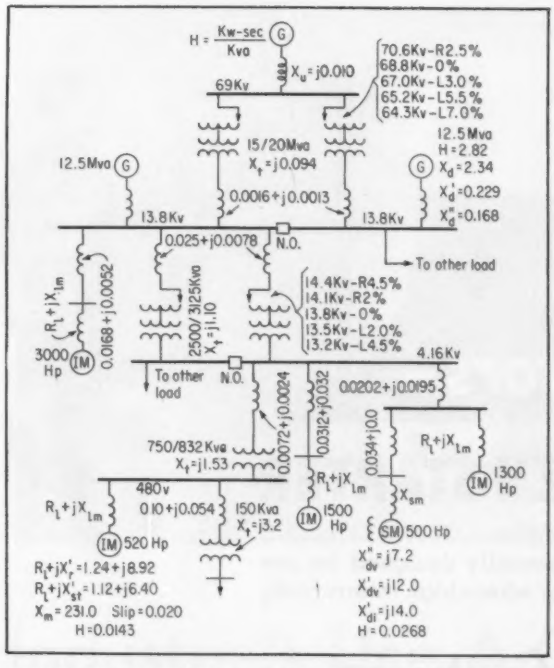

PLUGGING DIAGRAM shows distribution system and circuit constants to be represented on analyzer for a particular study. Constants for only one equivalent induction motor are shown; all four require comparable data in actual study

as an impedance to ground, with a value equal to its starting impedance. A more elaborate representation of the synchronous generators, simulating the effect of automatic voltage regulators and field time constant may be used to calculate voltage as a function of time.

Problems associated with loss of generation, either utility tie or local generation, are another area where the a-c analyzer may be used advantageously. Undesirable operating conditions can be detected and a load shedding program set up to assure service continuity to critical areas. Loss of any or all utility ties can be simulated and the resulting variation in system voltage, frequency, and line loading can be calculated as a function of time. It is possible to determine whether the system will regain stability if only one tie remains in service and/or whether power surges across the relays will cause them to drop the remaining tie.

Long Relaying Times Breed Instability

Because of the relatively long relaying times in industrial systems, transient instability problems exist in some plant distribution systems. Feeders are often protected only by over-current relays without instantaneous trips; minimum clearing times of 15 to 20 cycles are common.

Thus when a 3-phase fault occurs, instability may result if the fault persists too long or the network tying the machines together has too high an impedance. Then severe voltage dips may take place, induction motors may stall, synchronous motors can be damaged, and relays may operate to disrupt system operation.

In a stability study, the system is represented in miniature on the analyzer, a disturbance is introduced, and the system behaviour is calculated to determine whether it is stable or not.

Although the majority of faults involve only one or two phases to ground, where the power that can be stably transmitted is considerably greater than for 3-phase faults, the industrial power engineer ought to determine whether more severe faults can be tolerated. If an investigation of 3-phase faults is not practical, at least the effect of less severe, and more common, one-phase and 2-phase faults should be determined.

Component Data Must Be Accurate

When a system expansion or a change in service from the utility is contemplated, switchgear momentary and interrupting duties under the new conditions should be evaluated. With the simplified empirical procedure developed by the AIEE for calculating interrupting duty, the fundamental frequency symmetrical fault currents on an unloaded system are determined, using the prescribed reactances to represent the various machines. The resulting short circuit current is multiplied by an empirical factor to give proper asymmetrical interrupting or momentary duty as a function of breaker clearing time and voltage level.

In systems with large concentrations of induction motors, the contribution of fault currents by these motors during the subtransient or initial period is an important consideration, and may still be important during the period at which interrupting duty is specified.

Preparing for an a-c analyzer study includes:

1. Collecting all required system component data and relay settings to set up equivalent circuits.
2. Reducing the system to a reasonable equivalent.

The results of the study will be only as accurate as the information fed into the analyzer. Machinery constants can be obtained from the manufacturer. Feeder and cable constants can be calculated from tables or other generally available data.

Local generators and utility ties are represented by a-c-voltage sources, called "generator units". Voltage magnitude and phase angle are independently adjustable to represent the generator internal voltage and the terminal kw and kvar loading.

Line constants, resistance and reactance, are set on "line units." If line capacitance is important, "capacitor units" are switched in the circuit. System loads are represented by "load units," which are also made up of resistance and reactance but are of greater range than the "line units".

Reducing a system to a reasonable equivalent and establishing a suitable kva base is largely a matter of judgment and experience. The only general rule is that the extent by which any area is reduced should be determined by its importance in the system as a whole. In many cases, some reduction can be made before converting system constants to a common kva base. Selection of the kva base should then be based on magnitudes of the circuit constants to be represented and on the range of quantities to be measured on the analyzer. Consequently, instrument ranges of the analyzer to be used should be obtained before selecting the kva base.

All system component data should be marked on a one-line diagram which includes all pertinent sources of

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Victor, New York

generation, transformers, reactors, capacitor banks, synchronous condensers, and distribution lines. Substation names and base voltages on the buses should also be indicated. The per-unit one-line diagram resembles the system one-line except that breakers and disconnects are not shown. After a suitable kva base is selected, all per-unit system constants are calculated and entered on the per-unit diagram. The system can then be reduced to fit the study being made. The process of lumping line and transformer impedance follows network theory.

Because there is a practical limit on the number of motors that can be represented, it is usually necessary to represent all the motors on a feeder or group of feeders by equivalent motors with the same properties as the group they represent. For an equivalent of a group of induction motors to be "exact", all motors in the group must have equal:

1. Impedance on the motor kva and kv bases
2. Inertia constant (H) on the motor kva base
3. Per cent operating slip.

In addition, the load torque-slip characteristics must be the same and the impedance between motor terminals must be negligible compared to the total impedance of the group. Although a departure from these requirements would make the equivalent inexact, it might be entirely satisfactory for the purposes of the study.

Generally speaking, variation of induction motor per-unit transient impedance with variations in rated hp and voltage is small. There are variations in the H constant and load as frame size and rated speed vary. Similarly, per cent rated slip depends on efficiency and other factors.

Alternative Representations Possible

If the group of motors includes many sizes and if it is impractical to use more than one equivalent motor, several alternatives are available:

1. Using weighted averages, determine the characteristics of the average motor and use it for the equivalent.
2. Use the smallest H and slip to represent the group. This usually makes the representation conservative.
3. If one motor's behavior is especially important and its characteristics are reasonably similar to the rest of the group, it may be used to represent the entire group.

If an average load characteristic is impractical or not available, it simplifies the analysis to assume that mechanical torque is constant and independent of speed. Because speed variation of a stable motor during a transient disturbance is not likely to exceed 20% and may not exceed 10%, this method is not as conservative as it may appear at first.

Where there is a mixture of induction and synchronous motors, it is generally necessary to have an equivalent induction motor and an equivalent synchronrous motor.

The plugging diagram shows the distribution system and those components which will actually be represented for a particular study. Each type of study may require a different set of system constants for generators or motors. Thus momentary duty studies require subtransient reactances of both motors and generators, while interrupting duty studies require subtransient reactances of generators and transient reactances of synchronous motors, but not induction motor reactances.

In a study involving a utility tie, the utility system must be represented. If it is quite large compared to the total load in the industrial plant, a simple but reasonable equivalent may be an infinite bus behind an equivalent short circuit reactance. For transient stability studies, the results will usually be somewhat conservative if the equivalent H of the utility system is assumed to be infinite.

When a system load flow is conducted, the connected load at each bus represented must be specified in advance. This involves knowing or estimating the load kw and kvar at each bus for each operating condition or load level to be investigated. System loads may be calculated from the voltage, current and p.f. readings on the feeders in the actual system. The kw output of each system generator and the voltages maintained at specific buses are then specified. For a given utility interchange, system losses will be picked up by one of the generators which is specified in advance.

Orderly Recording System Necessary

The usual result of an a-c network analyzer study is a report summarizing the results and all the data obtained. Documentation and analysis of the results is greatly simplified by recording data on a simplified one-line diagram for each study and each set of conditions.

Because of the volume of data which may be obtained, an orderly recording system should be set up at the beginning of the study and all results, conclusions and possible recommendations recorded as the study progresses, while they are still very clear in the mind. Diagrams should be suitable for recording specific data and large enough for reproduction.

Stability studies are usually recorded in the form of machines angles and motor speeds as a function of time. It may also be desirable to plot various key voltage buses as a function of time. In investigating loss of a utility tie, a plot of bus frequency as a function of time should be made.

Here Are Some Typical Industrial Users:

1. Carbide and Carbon Chemical Co: Load flow, transient stability, short circuit
2. Columbia-Southern Chemical Corp: Load flow, transient stability, voltage dip, short-circuit
3. Diamond Alkali Co: Load flow
4. Dow Chemical Co: Load flow, transient stability
5. Erie Mining Co: Load flow, transient stability, short-circuit
6. Kaiser Aluminum Co: Load flow, transient stability
7. Shell Oil Co: Load flow, transient stability, short circuit, voltage dip, and load shedding
8. Socony Mobil Oil Co of N J: Load flow, short circuit, transient stability, loss of generator field, voltage dip
9. Standard Oil Co of Cal: Load flow, transient stability, short-circuit
10. Standard Oil Co. of Ind: Load flow, transient stability, voltage dip and load shedding

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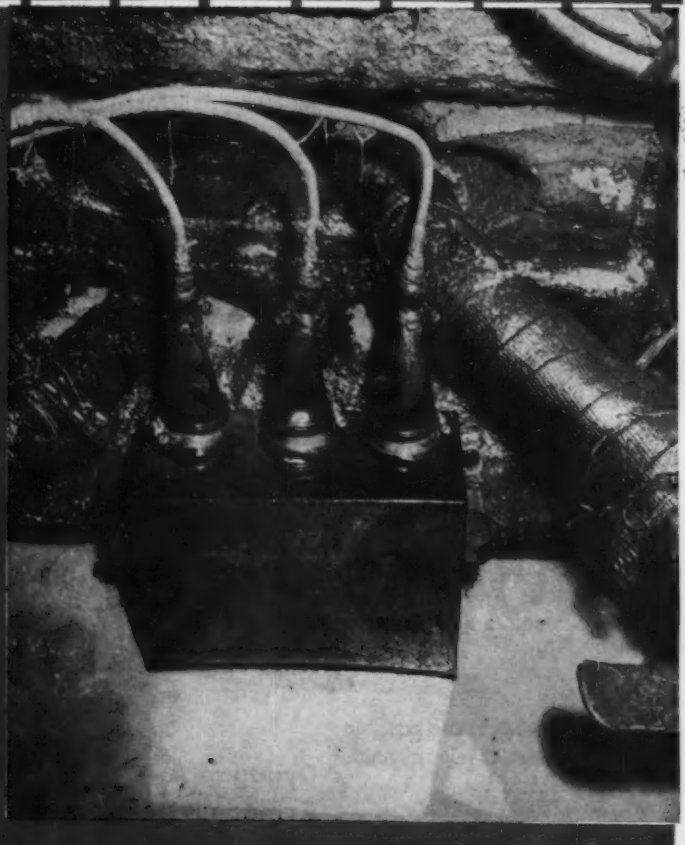

Submersible type mine) cased capacitors. Ordinarily many of the capacitors used by Consolidated Edison Company are submerged in water. (Installation was partially drained by Consolidated Edison Company so that photograph of this submersible type Tobe capacitor could be taken.)

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Books

Television for Industry

Closed Circuit TV System Planning. By M. A. Mayers and R. D. Chipp. Published by John F. Rider Publisher, Inc, 116 W 14th St, New York 11, N. Y. 264 pages, illustrated. Price $10.00.

Where, when, and how to use closed circuit television is clearly described in this book. It is written in layman's language for the purpose of assisting industrial managers and others in evaluating the advisability of using this new tool. Numerous examples, including a few about the utility industry, are included.

What Are Transients?

Transients in Electric Circuits. By G. V. Lago and D. L. Waidelich. Published by the Ronald Press Co., 15 E 26th St., New York 10, N. Y. 382 pages, illustrated. Price $7.50.

The increased use of computers and complex automatic control systems makes electrical transient state conditions just as important as steady state conditions. The purpose of this book is to equip electrical engineering students with the academic tools to handle these transient conditions.

Various transient circuit conditions, including applications of servomechanisms, are presented with exact mathematical treatment. Differential and integral calculus and introductory electrical circuit theory are presumed.

Books Recently Received

Synchronous Motors and Condensers. By D. D. Stephen. Published by Chapman & Hall, 37 Essex St, London W.C.2. 493 pages, illustrated. Price 60s.

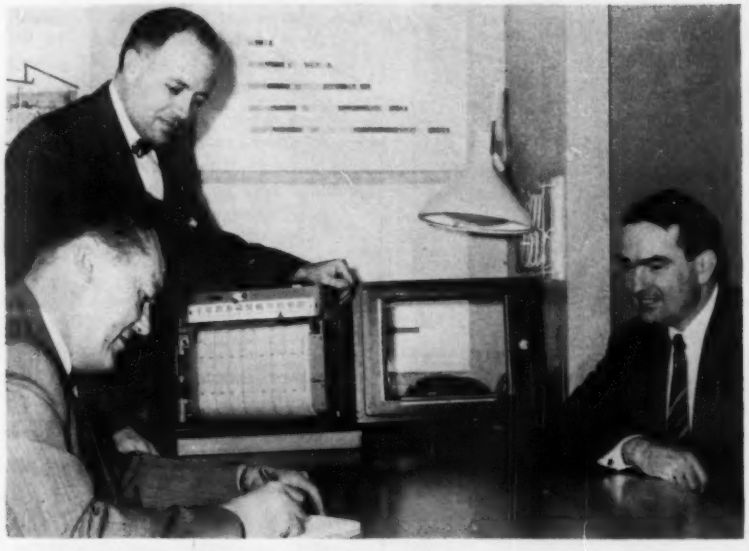
Basic Electrical Power Distribution, Volume I and II. By A. J. Pansini. Published by John F. Rider Publisher, Inc, 116 West 14th St, New York 11, N. Y. 256 pages, illustrated. Price $2.40 each.

Electrical Construction Materials List, May 1958. Published by Underwriters' Laboratories, Inc, 207 East Ohio St, Chicago 11, Ill. 422 pages.

Hazardous Location Equipment List, May 1958. Published by Underwriters' Laboratories, Inc, 207 East Ohio St, Chicago 11, Ill. 104 pages.

Electrical Construction Materials List, May 1958. Published by Underwriters' Laboratories, Inc, 207 East Ohio St, Chicago 11, Ill. 422 pages.

Manufacturers News



One Price Recorder Used to 24 Points

A multipoint recording potentiometer, capable of handling from 2 to 24 points by means of simple plug-in adapter units, and offered at one price, has been designed and produced by Weston Instruments, division of Daystrom, Inc, Newark, N. J.

The recorder is shown with its designers: (left to right) Vincent Matner, manager of production engineering; Ernest Upton, chief engineer; and Jay Nichols, manager of research and development.

The Model 6702 potentiometer measures inputs from thermocouples or transducers, whether voltages, frequencies, pressures, temperatures, pH, etc. It is designed to measure any number of variables by means of an inexpensive kit of change-over parts, namely a plug-in unit, a dial indicator and a print wheel. The change-over operation by screwdriver adjustment can be completed in 3 min.

Daystrom-Weston is able to offer this new model at one price, approximately $1450, according to a company spokesman. This is made possible by grouping related components in a simple and serviceable manner, regardless of source inputs (2 to 24) required by purchasers.

Standard Has New Design Transformers

In a move to cut transformer operating costs, a premium transformer with substantially reduced copper and core losses has been developed by Standard Transformer Co, Warren, Ohio. Based on operating data supplied by utility companies, Standard's engineers were able to design transformers having the lowest annual operating costs, according to Chester F. Buckley, president.

Due to a variation among the several utility systems it was necessary, however, to summarize the information as to: plant investment between energy source and primary terminals of the transformer; carrying charges; energy cost at generating sources; and improved load factors of residential and commercial load.

Comparing a conventional design transformer, 50 kva, 2,400-120/240 v, against the new design, Standard Transformer discovered, whereas the new design costs more, $515.00 as against $481.00, the annual operating cost for the new design is lower, $172.78 compared to $202.20. The ratio of losses may be changed for other sizes and voltages to provide the most favorable economic design.

In addition to economic benefits there are these advantages: shorter tank; less oil because of lower losses; better thermal time constant; lower noise level; approximately the same weight; improved regulation; and lower exciting current.

Patent Infringement Suit Filed by PLP

Preformed Line Products Co, Cleveland, Ohio, recently announced that it had filed suit against the City of Los Angeles and McGraw-Edison Co for infringement of PLP's Patent No. 2,761,-273 on dead-ends. Reason: City of Los Angeles purchased dead-ends manufactured by Fanner Mfg Co from Line Material Industries, division of McGraw-Edison Co.

The suit against Fanner Mfg Co, Cleveland, Ohio, filed October 29, 1956, for infringement of both armor rod and dead-end patents is still pending.

Dynagap Arrester Made Component of Transformer

For convenience of distribution lightning arrester users, the Ohio Brass Co, Mansfield, Ohio, is making Thorex Dynagap Type DV-T available now as a factory-installed component of distribution transformers. This saves time and trouble of separate arrester installation, plus the cost of incidental connecting material. Thorex arresters are readily supplied on request with many transformers, according to an O-B spokesman.

Because these arresters contain

(*Continued on page* 98)

public utility men prefer—

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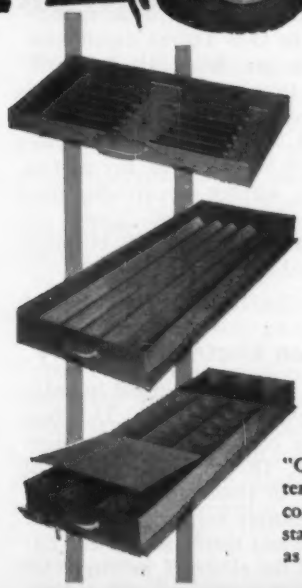

"Custom" features such as material drawers with adjustable compartments are available as standard or optional equipment, as required.

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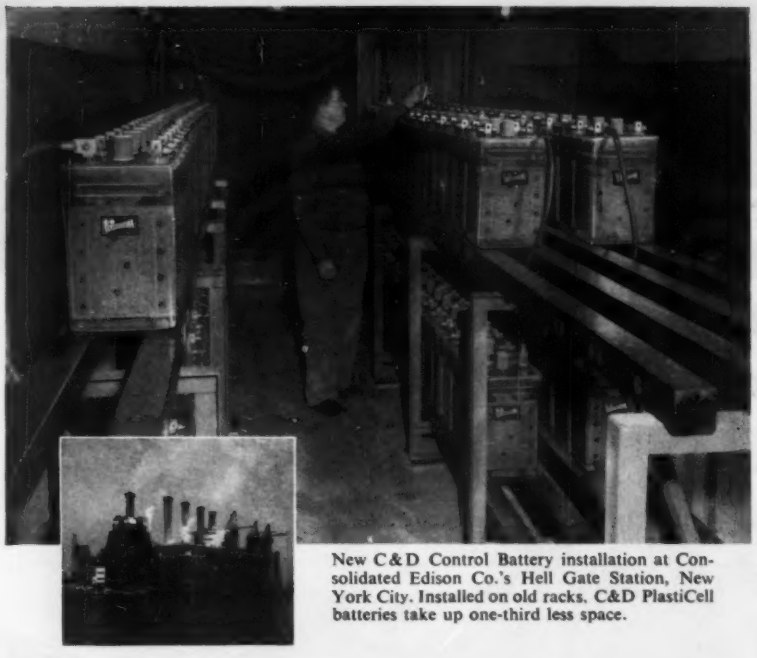

New C&D Control Battery installation at Consolidated Edison Co.'s Hell Gate Station, New York City. Installed on old racks. C&D PlastiCell batteries take up one-third less space.

Con Edison saves 1/3 space

...when replacing control batteries by installing C&D PlastiCell

Consolidated Edison, supplying the tremendous power demand of New York City and Westchester, recently replaced another make battery supplying the d-c house bus at its Hell Gate Station with a C&D PlastiCell battery.

The result—

a saving of a third of battery room space.

The C&D PlastiCell battery is used to control the motor-operated valves on gas and steam lines in connection with 900,000 pound per-hour high-pressure boilers and 450,000 pound per-hour low-pressure boilers. In addition, the battery supplies power for sequence trip controls, cubicle switches, forced and induced draft fan controls, and solenoids for motor breakers.

For space-saving, yes—and even more important, for complete dependability, long life, and reduced maintenance, specify C&D—the batteries engineered for control service. That's why C&D is your better battery buy. C&D batteries are engineered to provide a long, trouble-free service life. With PlastiCell (lead-antimony) you get a full 14 years of life and with PlastiCal® (lead-calcium) 25 years.

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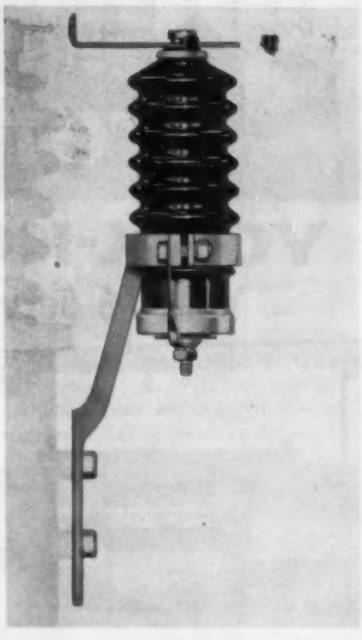
Since 1906

Sales and Service Offices in Principal Cities from Coast to Coast

Manufacturers of Sure-Cid ® Industrial Batteries • PLASTICELL and PLASTICAL ® Batteries for Communications, Control and Auxiliary Power • Producers of Autoloy • Silicon Chargers

Dynagap Arrester

(*Continued from page* 96)



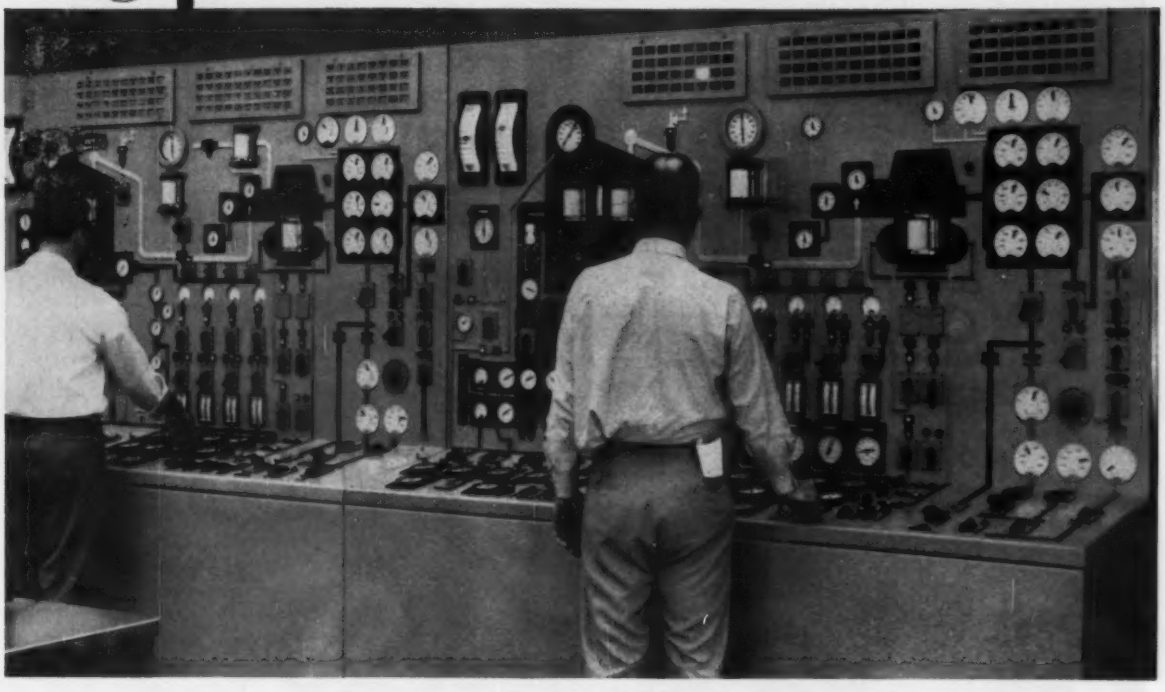
internal elements that are interchangeable with intermediate and station classes, they offer protective and durability characteristics formerly associated only with heavier-duty models—an innovation in the distribution field, stated the spokesman. The O-B Thorex distribution arresters are from 10 to 50% smaller than comparable products. Protective performance is not influenced by faulty current. Dynagaps may be placed on any part of a system without jeopardizing protective characteristics. These arresters are described in Publication No. 1402-H.

German Electrical Industry

West German electrical industry had a total turnover of $3.33 billion last year compared with $3 billion in 1956. This places the electrical industry in third place of German manufacturing industries behind the machine and textile industries. Exports of the electrical industry rose from $643 million in 1956 to $762 million last year, with a share of 21% in world exports. The German electrical industry holds third place, after the U. S. with 28% and Great Britain with 22%.

(*More Manufacturers News, page* 102)

How Copes-Vulcan control systems boost power plant efficiency



Copes-Vulcan puts combustion control at operator's finger tips

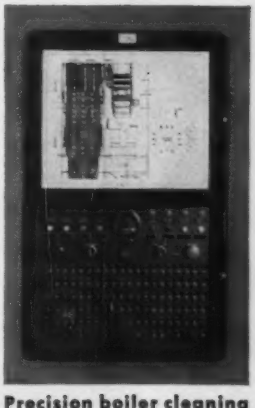
Equipped with easy-to-read recorders and control stations, this compact Copes-Vulcan panel centralizes operator control and simplifies boiler operation. This modern system features circuit simplicity with independent control loops on air flow, fuel loading and furnace draft. Drive units assure accurate positioning and fast response, and eliminate the need for interconnecting control loops.

A custom installation . . . a continuing service

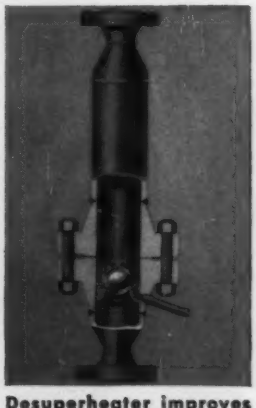
Copes-Vulcan Combustion Control is just part of an integrated boiler control system for regulating feed water, boiler steam temperature and boiler cleaning.

Whether furnished in individual units or integrated into a single system, each installation is tailored to meet specific requirements of generating capacity, load range and fuel. Copes-Vulcan supplies skilled service, when needed, for the life of the installation.

Write for Bulletin 1032 showing a Copes-Vulcan control system working at a showcase generating plant.



Precision boiler cleaning with Copes-Vulcan Selective-Sequence or Automatic-Sequential soot blowing systems. Space-saving panel permits easy monitoring, flexible programing . . . assures thorough cleaning with less steam and/or air. Write for Bulletin 1029.



Desuperheater improves temperature control. New Variable-Orifice Desuperheater* holds reduced steam temperature constant only 20° downstream from desuperheater outlet, even over a 50-to-1 load range. Write for Bulletin 1037. *Patent applied for

Copes-Vulcan Division
BLAW-KNOX COMPANY
Erie 4, Pennsylvania

Plowback of earnings into research and development
provides new approach to economics of transformer loading . . .

NEW INSULDUR SYSTEM PROVIDES 10% MORE FOR ALL WESTINGHOUSE

PROTECTS INSULATION, OVERLOAD CAPABILITY POWER TRANSFORMERS

Now used in all new Westinghouse power transformers, the Insuldur* system significantly retards the deterioration of transformer insulation. This system, another product of continuing research and development, utilizes an amine stabilizing compound which gives insulation the ability to withstand higher operating temperatures.

Regardless of the overload practice you may follow, Westinghouse transformers protected by the Insuldur system can carry more overload than any other transformer without the Insuldur system—with no additional loss of insulation life.

Thus, the Insuldur system in Westinghouse power transformers is your means of obtaining more overload—economically. For instance, if you can economically justify overloading a conventional transformer 125% for 24 hours, a Westinghouse power transformer with the Insuldur system can be overloaded 135% for the same time—*with no greater loss of insulation life.*

Ask your Westinghouse representative about the Insuldur system for power transformers . . . and the "Crumble Test" proof of added insulation strength.

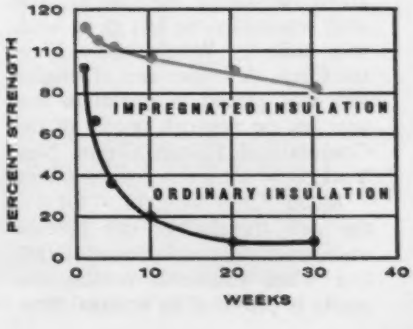
J-70885

*Trade-Mark

YOU CAN BE SURE...IF IT'S Westinghouse

The "Crumble Test" demonstrates superior heat-aging resistance of Westinghouse Insuldur-system insulation . . . proves that overload conditions endanger the insulation life of power transformers without the Insuldur system. Visual inspection (left) shows charred insulation not protected by the Insuldur system during overload tests. Insuldur-system insulation shows little change. Where ordinary insulation has "died" (right), Insuldur-system insulation has bounced back, full of life . . . providing safe extra overload capability.

◀ Bob McCollom, Manager, Westinghouse Power Transformer Department, points out that the overload capability added by the Insuldur system is now available in new Westinghouse power transformers.



Aging-rate curves of impregnated insulation and ordinary insulation prove Insuldur system's positive resistance to aging. After 30 weeks at 135°C, Insuldur-system insulation is 10 times stronger. ▶

ESCO Produces Octagonal Reactor

A choke manufactured by the ESCO Mfg Co, Greenville, Texas, will be used in a joint Accelerator Project of the University of Pennsylvania and Princeton University with the Atomic Energy Commission. The choke, an example of design specialization, is octagonal and consists of eight separate coils mounted on an iron core with eight air gaps. Complete with circular tank and oil it weighs 17 tons. It is shown above being checked prior to shipment.

This choke will be part of the prototype power supply providing current for model magnet. Its chief purpose is to check design data. If test results are satisfactory, the assembly will be scaled up by a factor of 40 (energy wise) to supply power to the 16 magnets of the three Bev synchroton to be in operation in 1960. The final power supply will contain a choke for 16,000 kva, capacitor banks totalling 60,000 kva and a 3,500 hp motor-generator to supply the losses. The final choke is expected to weigh 125 tons.

Vapor Gas Transformer Goes into Operation

A power transformer cooled and insulated by fluorocarbon vapor/gas has been energized by the Baltimore Gas & Electric Co at its Havre de Grace substation. The unit, reportedly the first of its kind, was built by Westinghouse Electric Corp. A similar unit of smaller size was placed in operation last year on the network system of the Consolidated Edison Co of New York.

Rated 7,500 kva, 33 - 4.4 kv, the new transformer can operate under overload conditions at 10,000 kva when additional cooling capacity is provided by external fans. It has been designed with a basic impulse level of 200 kv. In addition to cooling, the fluorocarbon material is adaptable because of its insulating properties.

Unistrut Expands Service in West and Southeast

Unistrut Products Co, Chicago, has established three new company-owned subsidiaries, one in California, one in Georgia, and another in Ohio, according to George W. Butler, president.

Unistrut Northern California, Berkeley, will expand the company's service in Western United States and Canada through sales, engineering and warehousing facilities. George McKay of Chicago has been named general manager.

Unistrut Steel Service Co., Atlanta, will serve the southeast area. Lem Hightower and Curtis M. Wood, both of Atlanta, become associated with the Georgia subsidiary.

Unistrut Steel Products Co, Cincinnati, will serve the East Central section of the United States. C. Meeker Evans has become associated with the company.

Pressure Relief Unit Goes on Power Transformers

A mechanical pressure relief device, suitable for transformers, has been designed to relieve any sudden or accumulated internal pressure at a predetermined pressure. This device was developed by Pennsylvania Transformer Division, McGraw-Edison Co, Canonsburg, Pa. It will be available as standard equipment in the near future on all the company's power transformers.

M. Aronson, mechanical engineer of the transformer manufacturer, said the relief unit is applicable for oil, gas, or askarel-filled transformers and compartments. He stated that test results were gratifying. Each unit had at least 1,000 operations under a gas pressure. Normal accuracy of the device is within $\pm 10\%$ of the predetermined pressure setting. A combination alarm switch and visible indicator alarm can be provided.

Ability of the device to reset and reseal itself is highly significant on askarel transformers, said Aronson. This characteristic is advantageous for underground network and subway transformers which are subjected to occasional flooding because the valve will allow no water to enter these units.

Chance to Expand Crossarm Production, Purchases Plant

A. B. Chance Co, Centralia, Mo., has signed a memorandum of intent to purchase the Chehalis, Wash., Crossarm Plant of Joslyn Mfg & Supply Co; the purchase is to be completed August 1, according to

F. Gano Chance, president and board chairman of Chance Co.

The Washington plant will expand Chance Co crossarm product facilities which include five American Crossarm & Conduit Co plants acquired in 1957. The latter company was dissolved June 30 into the Chance Co and will operate as the American Crossarm & Conduit Co of the A. B. Chance Co.

Fred Masterson who was president of American Crossarm and Conduit Co has been made a vice president of the A. B. Chance Co.

Allis-Chalmers Expands Plants and Facilities

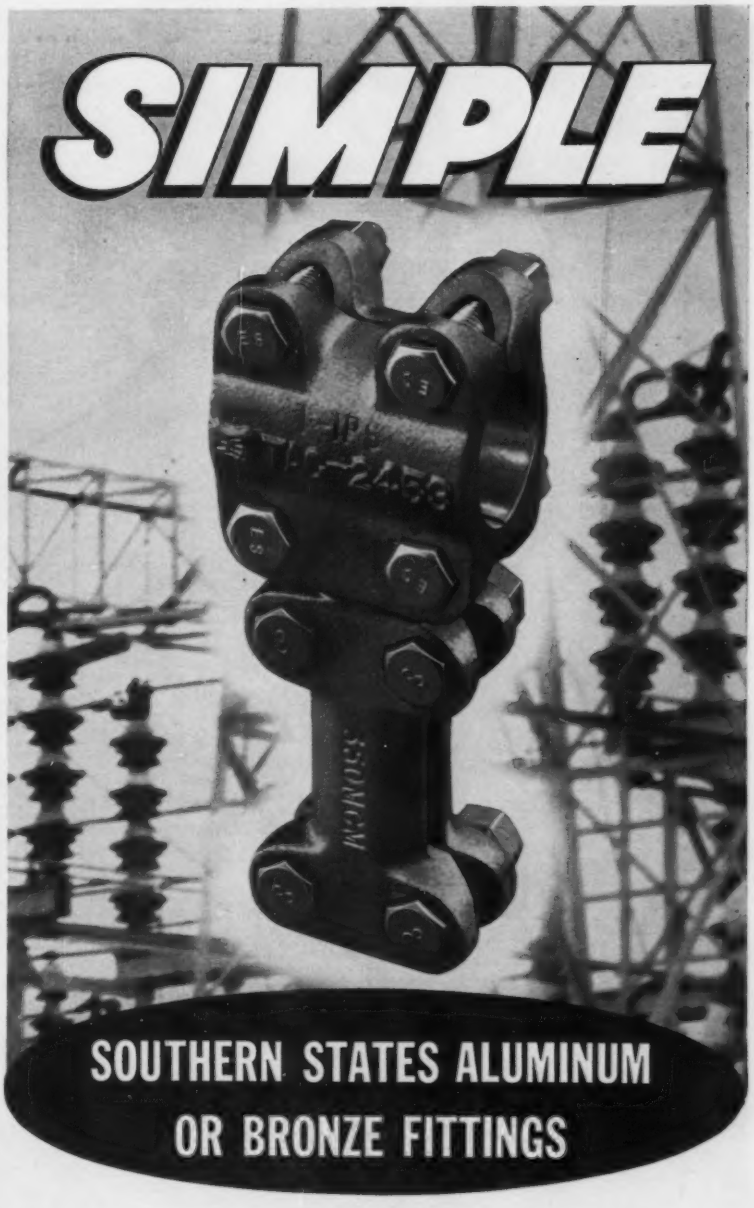
• For the design and construction of 12 full size pump-turbines for the Tuscarora Power Plant of the Power Authority of the State of New York a modern laboratory test arrangement with a model reversible pump-turbine is being used at the West Allis, Wis. Works.

The full-size units, each rated to pump 3,400 cu ft of water per sec against 85-ft head, will be about 14 times the dimensions of the model. Each of the Tuscarora pump-turbines as turbines will develop 28,000 hp under 75-ft head. All units will be direct-connected to Allis-Chalmers generator motors rated 25,000 kva as generators at 80% p.f. and 37,500 hp as motors at 100% p.f.

• To more than double the former capacity for casting epoxy resin instrument transformers that department has been enlarged at the Pittsburgh Works. It has new gas-fired ovens, mechanical mixers, aluminum molds and a modern conveyor system. Stirring cycles are initiated by push buttons and each batch cut off automatically when completed.

• To expand computer facilities an IBM Model 704 Electronic Data-Processing Machine, capable of adding 720,000 ten-digit numbers a minute in floating point, has been added at the West Allis Wis. Works.

A staff of 10 engineering analysis and eight mathematicians have been developing programs for the 704 for over a year. Design programs already developed include those for steam turbines, nuclear reactors, transformers, motors, generators, and transmission system studies.



The clean, simple lines of Southern States connectors didn't just happen. The recessed hexagonal bolt heads, or proven alloys, didn't either. Nor did the resultant over-all strength, ruggedness, and durability of these high-quality fittings. All of those characteristics, which you look for in connectors, are the result of careful engineering, backed by more than 25 years experience in producing these products — from drawing board, to foundry, to you.

SS SOUTHERN STATES
EQUIPMENT CORP.
HAMPTON, GEORGIA

IN CANADA: Dominion Cutout Co., Ltd., Toronto

Technical assistance, dependable service by Alcoa help maintain schedule on first stage of 1,186,000-kw development

In a few weeks the first of four generating units will begin operating at Idaho Power's Brownlee Dam Project. Its completion signals a new era in the development of the power-hungry Northwest and marks the beginning of a farsighted program by Idaho Power Company to spark the region's economic growth.

Harnessing the roaring waters of the Snake River as they tumble through America's deepest gorge, the Brownlee Dam is the first of three giant hydroelectric projects which will be built in Hell's Canyon by Idaho Power Company. Because of the remote and rugged nature of the country, they each represent a spectacular challenge to engineering skill and resourcefulness.

All four of the generating units at Brownlee will be in operation by December 1958, little more than three years after construction began on the 400-ft rock-fill embankment that is the world's second highest. Initial capacity then will be 360,000 kw—a head start on the 1,186,000 kw which will ultimately be generated by the three dams.

A mushrooming network of electrical transmission is springing up at a furious pace to utilize Hell's Canyon's power. Alcoa® Aluminum Conductor will carry 230,000-volt power across miles of mountain wilderness. A new substation at American Falls, an expanded station at Boise and Brownlee's switchyard have Alcoa Aluminum Bus, Tread Plate and Pipe for wiring duct along with thousands of welded and bolted fittings—all made from Alcoa Aluminum.

IDAHO POWER COMPANY USES ALCOA® CONDUCTOR TO HARNESS HELL'S CANYON'S MIGHTY MUSCLES...

(LEFT) World's second-highest rock-fill embankment at Brownlee Dam reaches a height of almost 400 feet, contains a 57½-mile reservoir on Snake River.

(TOP) Alcoa Aluminum Conductor spans lonely mountain wilderness between Brownlee Dam and Boise on more than 400 steel towers, each over a hundred feet high.

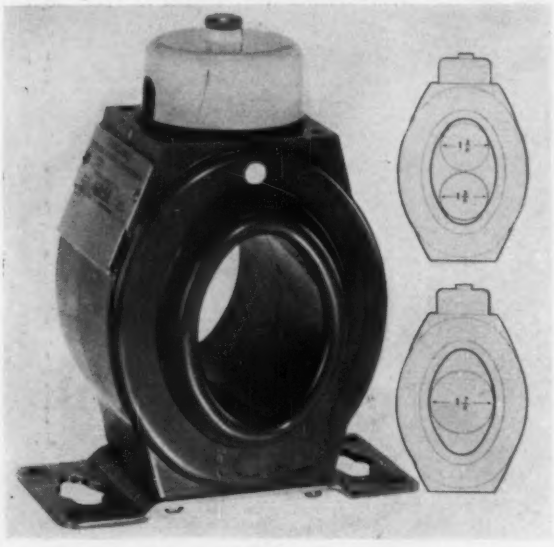
(BOTTOM) Alcoa Aluminum ACSR—in tension stringing equipment.

Alcoa, the pioneer in the development and manufacture of conductors and accessories for the electrical industry, was in a unique position to help with this Herculean undertaking. Because they were called in at the planning stages, Alcoa's experienced engineers were able to reduce costs and suggest ways to cut installation time. On-the-spot assistance by Alcoa's field advisor helped keep the job moving. Dependable equipment, delivered on schedule, minimized delays and overtime. For more information on how Alcoa's service before, after and during *any* job, big or small, can benefit you, call Alcoa or write Aluminum Company of America, 2306-G Alcoa Building, Pittsburgh 19, Pa.

ALCOA ALUMINUM
ELECTRICAL CONDUCTORS AND ACCESSORIES
ALUMINUM COMPANY OF AMERICA

Your Guide to the Best in Aluminum Value

"ALCOA THEATRE"
Exciting Adventure
Alternate Monday Evenings



600-V Current Transformer . . .

. . . for indoor or outdoor use is offered in double range 200/400-amp rating and in standard 200, 400, 600, and 800-amp ratings. All ratings of the Type BH transformer have 0.2 continuous current factor and 0.3 accuracy at Burdens B-0.1 and B-0.2. The 400, 600, and 800-amp ratings are also in 0.3 accuracy class at Burden B-0.5. Elliptically shaped opening combines advantages of round and obround types for accommodating large conductors. Top surface is flat and has tapped mounting holes for secondary lead duct or channel. Unit is available in window and flat bar construction. It is small and light.

Sangamo Electric Co, Springfield, Ill.

Automatic Meter Tester . . .

. . . permits fast, accurate tests of large quantities of single-phase self-contained w-hr meters. This electronic equipment provides direct, digital read-out of per cent registration and has provision for automatic print-out, IBM card, or tape punch-out. Known as the ETU, it has automatic sequencing through full, lag, and light load calibrations. Read-out is to 0.1% on heavy and inductive loads and 0.01% on light load. Complete test—one revolution each on heavy, inductive, and light loads—takes about 56 sec. Unit includes precision reference standard, loads and control, electronic control unit, gated counter, and storing or recording devices.

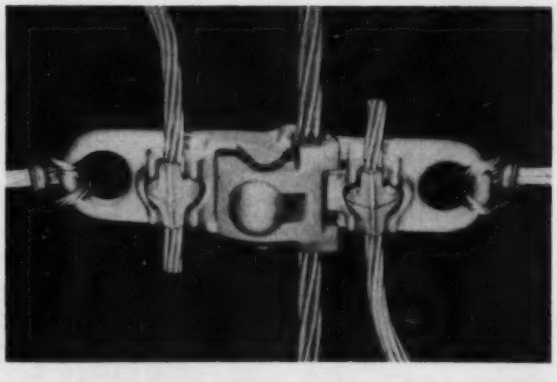
General Electric Co, Meter Dept, Somersworth, N. H.

Neutral Mid-Span Clamps . . .

. . . for open wire or triplex secondaries may be used just off the pole to eliminate brackets and knobs and provide additional climbing space. Secondary runs can be made directly from these clamps, producing a saving in triplex drop cable. Eyebolt provides a terminal for bonding the house service neutral to the secondary neutral. The heavy dead-end eye is supplied to the secondary neutral for taking bails or inserting thimbles up to ½ in. for serving cable. The clamp is designed for No. 4 to 2/0 ACSR mains and No. 8 to 1/0 ACSR taps. Three types are available.

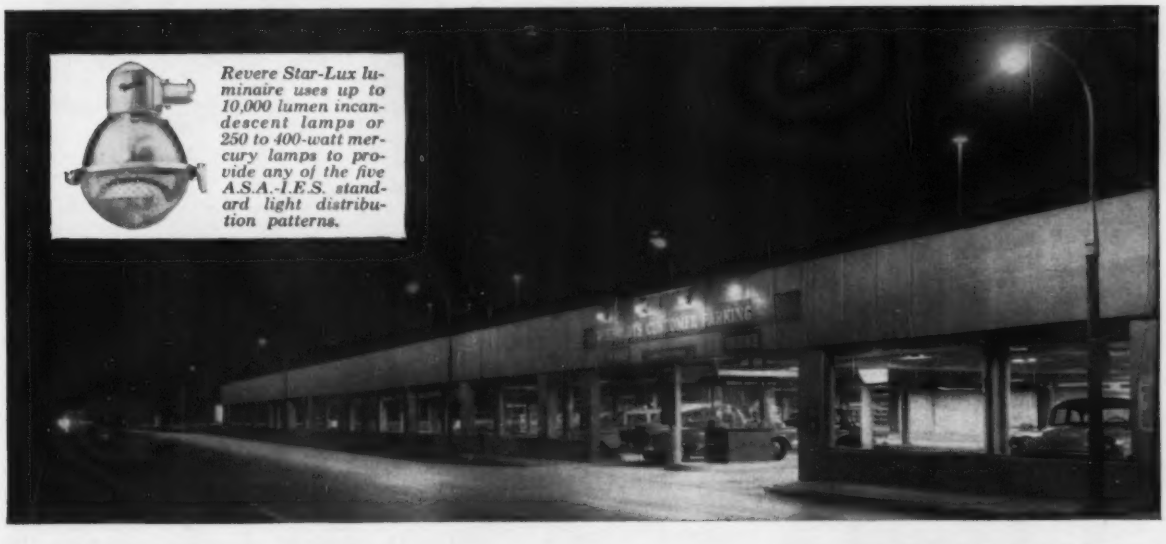
Anderson Electric Corp, Birmingham, Ala.

(*More New Equipment on page* 108)



Daytime scene of River Forest, Illinois street using Revere Star-Lux incandescent street lighting luminaires on converted concrete poles.

REVERE PLANNED STREET LIGHTING



Revere Star-Lux luminaire uses up to 10,000 lumen incandescent lamps or 250 to 400-watt mercury lamps to provide any of the five A.S.A.-I.E.S. standard light distribution patterns.

Planned street lighting demands different types of lighting for different traffic conditions. As the night photograph shows, the Revere Star-Lux provides moderately-traveled streets with uniform, moderate-intensity lighting . . . efficiently and economically.

The Star-Lux is a versatile and efficient member of the reliable line of Revere street lighting equipment. Recently-developed features of the Star-Lux include a built-in ballast compartment in the fixture head and a twist-lock plug in the head to accommodate a photo-electric control unit. Write for Revere Street Lighting Catalog.

Other luminaires in Revere's complete line

For heavily-traveled streets—Revere Endoval uses 11,000 or 21,000 lumen mercury lamps for high level illumination. Reversible slip-fitter for mounting horizontally or with 10° tilt.

For residential streets—Revere Urban-Lite makes efficient use of 100, 175 or 250-watt mercury lamps for uniform light in areas where lower intensity light is adequate.

Revere ELECTRIC MFG. CO.

OUTDOOR LIGHTING

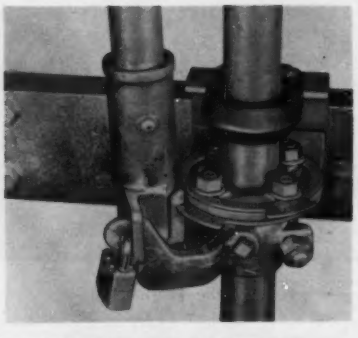
Revere Electric Mfg. Co. • **7420 Lehigh Ave.** • **Chicago 31, Ill.**

Available in Canada thru Curtis Lighting, Ltd., Leaside, Toronto, Ontario

Network Transformers . . .

. . . with spirally laced cores are smaller, lighter and have improved electrical characteristics. In the "Evans core" construction, core steel is preformed on mandrels, slit at every other turn, and laced by hand through the three sets of high and low voltage coils. Making more efficient use of the grain oriented

steel, the design permits the magnetic flux to follow the natural grain path around the corners with minimum loss. Units include 300, 500, and 750-kva, in ratings up though 15 kv. Reductions in size are exemplified by the 500-kva unit, which is only 53 in. high, compared to 70 in. for the previous design.
General Electric Co, Schenectady 5, N. Y.



Torsional Switch Handle . . .

. . . for manual operation of power switches can be used on all vertical-pipe operating mechanisms with rotation of 180 deg or less. Main features include optional up or down hinging of handle; clockwise or counterclockwise rotation; simple adjustment of "open" and "close" stops; and automatic unlatching. Mounting plate bolts directly to pole or substation structure. Handle may be either wood or steel. A sealed-contact, multi-revolution grounding ring is optional accessory.
Line Material Industries, McGraw-Edison Co, Milwaukee 1, Wis.

Insulated Ladder . . .

. . . resists breakdown with 120 kv applied between rungs or 2.9 kv applied to rungs. Made by moulding fiber glass reinforced plastic over a balsa wood core, this weatherproof ladder is suitable for manhole work. Aluminum rungs are coated with grit-embedded neoprene to prevent slipping. Rungs are plastic welded to side rails to eliminate twisting.
Putnam Rolling Ladder Co, 32 Howard St, New York 13, N. Y.

Mercury Floodlight . . .

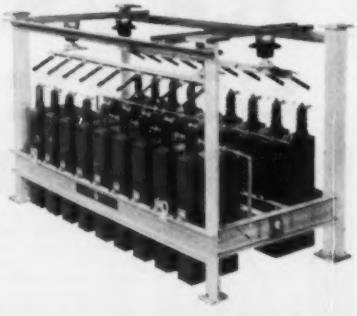
. . . has choice of four lenses and three reflectors, providing beams from 75 deg wide to 163 deg wide. This Type MVF general purpose unit is rated 1,000 w and is available with candlepower up to 236,000. Unit operates in temperatures down to —30 F. Other features include rear door relamping, spun-sealed lens.
Crouse-Hinds Co, Syracuse 1, N. Y.

Safety Sleeve Harness . . .

. . . for linemen holds rubber sleeves in correct position for maximum safety and comfort without binding or crawling. Elastic unit gives in all directions to conform to any stretch or strain. It fits any man and is easily adjusted. It may be worn with any standard type rubber sleeves.
Wye Mfg Co, 300 E. Main St, Louisville, Ky.

Pull and Splice Box . . .

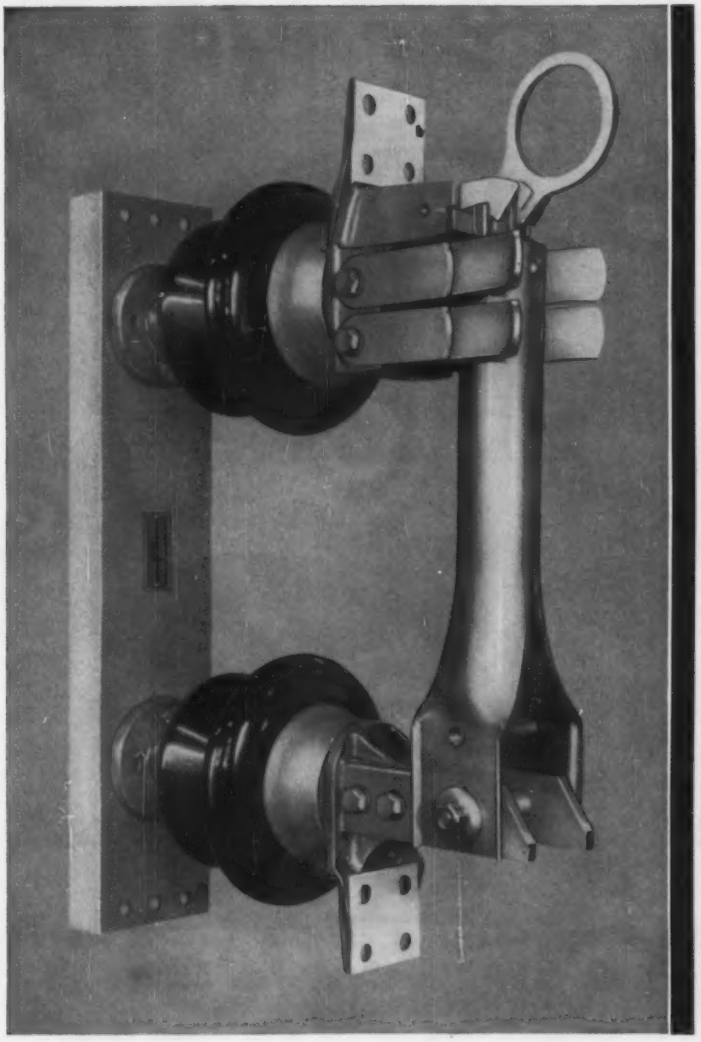
. . . for service up to 5 kv combines moisture, fungus, and corrosion resistance with compactness and ease of installation. Known as the Pull-n-Splice Box, it has an easily removed dome. Phase legs can be spliced through one-piece low resistance copper alloy connectors, a 5 kv model has higher dome to provide room for insulated pigtail splices. Line includes weatherproof and explosionproof types in 600 and 5,000-v models.
O. Z. Electrical Mfg Co, 262 Bond St, Brooklyn 17, N. Y.



Aluminum Stack Racks . . .

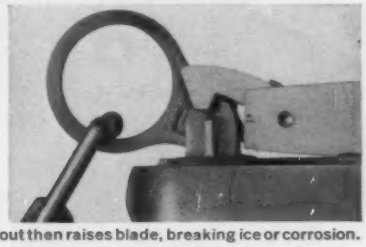
. . . assembled with 50-kvar capacitors, fuse holders and bus work, are 15 to 25% lighter than racks with galvanized steel construction. Designed to supply bulk kvar on transmission, subtransmission, and distribution circuits, these units require less installation time and reduce strain on base and stack insulators. Racks do not require painting, even in industrial or coastal areas. Equipments are available with 8 to 24 capacitors, supplying 400 to 1,200 kvar, and may be used on circuits rated 2.4 kv and up. Partially assembled, 8-ft high, aluminum substructures to elevate racks are also available.

In the issue of July 7, 1958, these stack racks were erroneously credited to another manufacturer. The correct manufacturer is **General Electric Co, Schenectady 5, N. Y.**



1. Operator inserts switch hook into 3-inch ring . . .

2. . . . and pulls down, raising latch fingers.



3. Blade pryout then raises blade, breaking ice or corrosion.

4. Blade is opened . . . latch returns to original position, ready for re-entry of blade.

RUGGED, POSITIVE-ACTING OUTDOOR DISCONNECT . . . the DELTA-STAR hook-operated B-2K switch

Here is a reliable heavy-duty hook-operated switch which offers the maximum in efficiency and ease of operation. Extreme rigidity of the tubular blade and formed hinge prevents contact misalignment even when the operator must stand to one side to open or close the switch.

A strong blade pryout makes operation positive even under heavy ice and corrosive conditions. The spring-loaded blade latch prevents opening under short circuit. Large hook ring eliminates difficulty of inserting hook.

High-pressure contacts of rugged construction plus ample material for heat dissipation assure efficiency.

B-2K switches are available in ampere ratings of 400, 600, and 1200, and voltage ratings from 7.5 to 161kv.

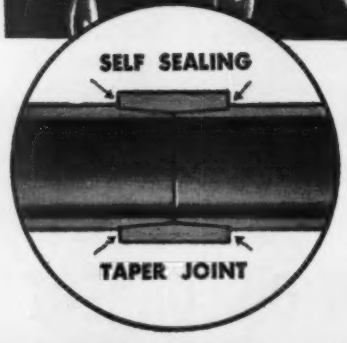
FREE CATALOG. Send for this new illustrated brochure, which gives full technical information on Delta-Star B-2K Disconnect Switches. Write today to Dept. 11B, Delta-Star Electric Division H. K. Porter Company, Inc., 2437 Fulton Street, Chicago 12, Illinois. District offices in principal cities.

H. K. PORTER COMPANY, INC.

DELTA-STAR ELECTRIC DIVISION

Connors Steel, Delta-Star Electric, Disston, Forge and Fittings, Leschen Wire Rope, Quaker Rubber, Refractories, Riverside-Alloy Metal, Vulcan-Kidd Steel, H. K. Porter Company (Canada) Ltd.

WATERTIGHT!



Orangeburg Fibre Conduit Prolongs Cable Life

Keep out corrosive ground waters, and you prolong the life of underground cables, say utility engineers!

Why? Because ground waters containing corrosive elements derived from the soil and concrete encasement attack cable sheath and shorten cable life. Orangeburg's impermeable wall and self-sealing Taper-Sleeve Joint shed them *"like water off a duck's back."* You get maximum protection with Orangeburg.

Orangeburg protects cables in many other ways. Smooth bore, low co-efficient of friction reduce incidence of abrasion. Its material is strong, tough, resilient, durable.

No other conduit is easier to install

Light, 8-foot lengths and a complete line of bends and fittings speed installation. Taper-Sleeve Joints tap water-tight in a jiffy. Orangeburg lays faster and at lower cost than any other type of conduit.

Orangeburg Fibre Conduit has prolonged cable life at minimum expense for utilities, municipalities and industry since 1893.

Distributed by Graybar Electric Company and by General Electric Supply Company. Branches and stocks in principal cities.

WRITE DEPT. EW-78 FOR CAT. 52

ORANGEBURG MANUFACTURING CO., INC., Orangeburg, N. Y. West Coast Plant, Newark, Calif.

ORANGEBURG®

FIBRE CONDUIT

Report on
Electrical
Business Outlook

Source: McGraw-Hill Dept. of Economics

I. A Capital Goods Recession

"As goes capital spending, so goes the economy." That's been a general rule of thumb in business forecasting, and 1958 certainly fits the pattern. The uncomfortable fact is that the current cutback in business investment will be both deeper and longer than in the '49 and '54 recessions.

The three major surveys of business investment plans give a pretty clear picture as to what's taking place. (1) The latest Commerce-SEC data chart the quarterly pattern for '58 which averages out 17% below last year's record level. This is a good bit lower than was thought likely last fall (2) The National Industrial Conference Board keeps tabs on capital appropriations made by the 1000 largest manufacturers. This series generally spots the turn some six to nine months in advance because of the time lag between appropriations and actual spending. It hasn't turned up yet. (3) The McGraw-Hill survey attempts to get a longer run picture by reporting advance plans by companies for 1959 through 1961. This year's findings suggest that capital spending will stabilize in '59 and be moving up again by the second half of next year.

The 25% drop measures the full decline from peak to bottom (see chart above). For industry as a whole, the high point was reached in the third quarter of '57. Spending dropped off very sharply as we moved into '58 and is now running at an annual rate of $30 billion. The low point probably won't be reached until mid-1959, but there's a good chance that it won't be much more than $2 billion lower than the current level. In short, the worst is over.

But capital investment will keep on declining gradually well into '59, even with a pick-up in production over the next six months. That's not unusual. You

don't see a major swing in the investment cycle overnight, and capital spending generally lags a bit on the upturn. Also, there's the problem of profits over the short run. With net earnings down some 40% so far this year, there's just not enough cash around to finance a quick turn-about in capital spending.

II. How Quick a Recovery?

How fast can capital spending make up the ground lost in the '58 recession, assuming a turn in mid-1959? Again, most signs point to a more gradual, slower recovery than in either '49 or '54. Best guess is that we won't hit a new record in capital expenditures until late '60 or 1961.

The slower rate of recovery ties in with one of the key findings in this year's McGraw-Hill survey. Companies were asked: "Assuming favorable economic conditions, what would be the maximum annual expenditure your company would make in the years 1958-1961. The limit on the up side for all industry turned out to be just about equal to the 1957 level of investment.

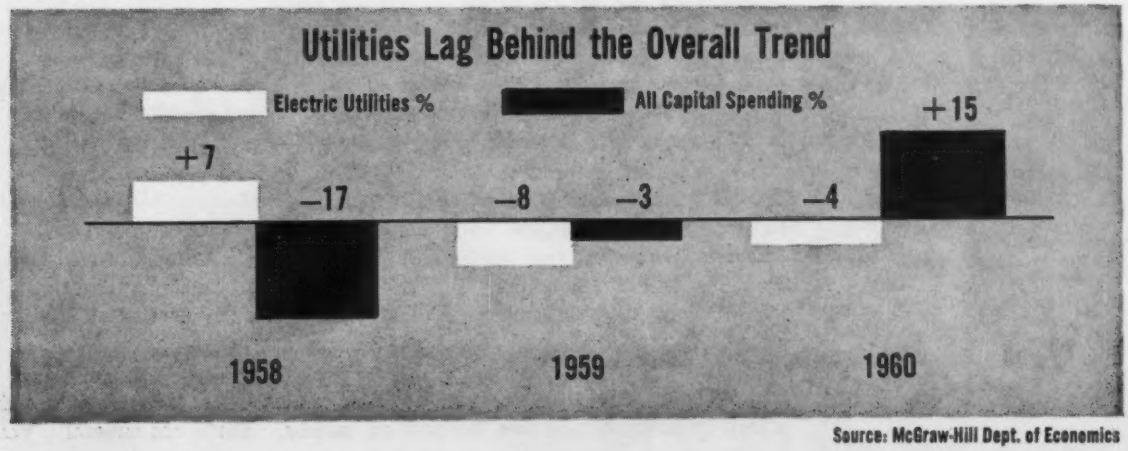
Of course, the pattern of recovery varies from industry to industry. The general trend over the next four years shapes up something like this:

- **Heavy plant construction will stay in the doldrums for quite some time.** This is particularly true of such basic industries as steel, non-ferrous metals and industrial chemicals, which are suffering from an extra heavy dose of excess capacity. For example, steel companies now plan to add less new capacity in the three years 1959-61 than they did in '57 alone.

- **Machinery and most lines of equipment will make a faster comeback,** starting modestly in '59 and gradually picking up momentum. But it will be a dynamically changing market. Machinery companies expect that some 22% of their '61 sales will be in new products not on the market last year.

- **Chemical processing industries**—chemicals, oil refining, rubber and paper—will hold up very well, even if by past standards the growth rate is a little subdued. The chemical industry is cutting back its spending by only 10% in '58, and advance plans for the next four years are good and solid.

Utilities are the only industry to buck the downward slide in '58 spending. Given the long lead time in electrical equipment, this year's $4 billion budget for

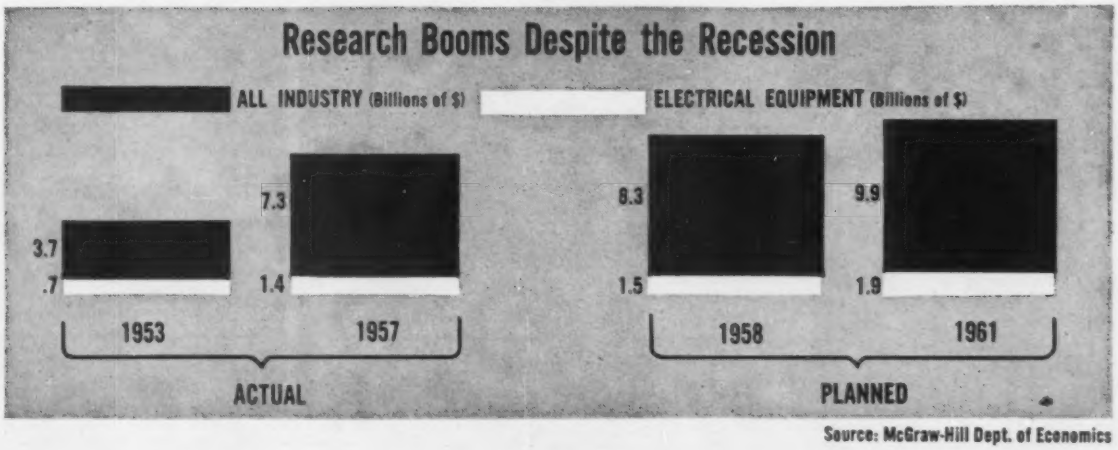


Source: McGraw-Hill Dept. of Economics

investor-owned companies is still pretty firm. The cutbacks will show up in '59, mostly in reduced outlays for generating equipment.

You got just this lagged pattern in the two previous postwar recessions. Power companies were up 20% in '49, but down 6% the next year. Spending was also down 4% in '55 when the rest of the economy was on the uptrend. A close look at the McGraw-Hill plans for the next four years suggests the same lagged trend—up 7% this year, down some 8% in '59, off a few more percentage points in '60.

Reserve capacity in the power field will set a high by late '58, with almost 16 million kw coming on stream this year. While a margin in the high twenties might have been enough to blunt long-range expansion plans seriously some years ago, the increasing importance of summer peak loads has made the figure somewhat misleading. And don't forget that a 30% margin would come in extremely handy in the event of another Korean-type conflict.



Source: McGraw-Hill Dept. of Economics

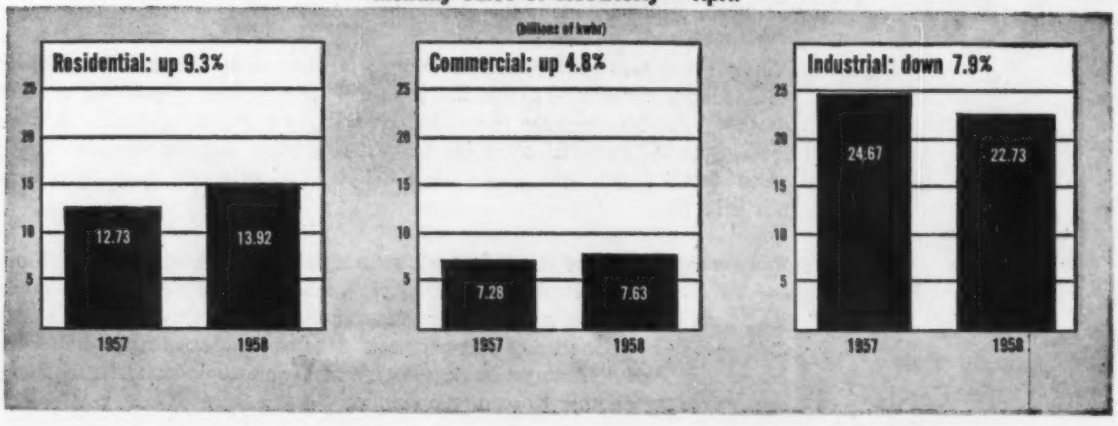
III. The Research Boom

Research spending is the one really bright spot in the '58 investment slump. Industry has pushed up its R&D budget by a full $1 billion for '58, despite the recession. And research promises to keep on booming right on into the 1960's.

Electrical manufacturers stand smack in the middle of the R&D boom. (As in other industries, the bulk of electrical research is done on the manufacturing level). In 1958 R&D outlays will tote up to $1.5 billion — up 9% over 1957. This ranks second only to aircraft manufacturing where the government picks up close to 90% of the tab. The big three in the electrical field—GE, Western Electric and Westinghouse—easily rank among the top 20 spenders on R&D. For the industry as a whole, about 6% of the sales dollar is being pumped into research spending.

Of course, right now the impact of R&D is still very gradual. The pay-off on the many new products and processes now under development will come primarily in the early 1960's—some five to seven years after the recent bulge in research spending. But what's taking place now in industrial labs is the best guarantee of new markets, record profits and a new surge in capital investment in the not too distant future.

Monthly Sales of Electricity— April



Power Statistics . . .

		Latest Month	Year Ago	Annual Change%
Capacity	April	131.13	122.27	7.2
Peak—Class I Systems (million kw)	Dec.	107.1	102.4	4.6
Estimated Dec. '58 Peak (million kw)	April	118.6	122.7	− 3.3
Production—billion kwhr	April	49.49	50.67	− 2.3
Hydro		13.00	12.05	7.9
Fuel		36.49	38.62	− 5.5
Sales—billion kwhr	April	46.60	47.20	− 1.3
Residential		13.92	12.73	9.3
Commercial		7.63	7.28	4.8
Industrial		22.73	24.67	− 7.9
Other		2.32	2.52	− 7.9
Fuel Consumption	April			
Coal—million tons		11.50	12.50	− 8.0
Oil—million barrels		5.02	6.47	−22.4
Gas—billion cu ft		99.63	98.80	0.8
Net Income Class A & B Co's—$ million	April	124.28	116.86	6.3
Residential Customers—millions	12 mos.	46.94	45.99	2.1
Revenue per kwhr	ended	2.54¢	2.59¢	− 1.9
Avg kwhr per customer	Mar. 31	3,244	3,021	7.4
Avg annual bill		$82.40	$78.24	5.3

Business Statistics . . .

Indexes: 1947–49 = 100				
FRB Industrial Production	June	138	145	−10.3
ENR Construction Cost	July	159.9	151.8	5.3
BLS Cost-of-living	May	123.6	119.6	3.3
New Orders for Machinery (1950 = 100)	May	134	149	−10.1
NEMA Sales				
Insulation materials	May	104	148	−29.7
Electric appliances		84	88	− 4.5
Wholesale prices				
Motors and generators	April	145.2	141.4	2.7
Transformers and regulators		147.6	147.4	0.1
Switchgear and fuses		172.8	164.4	5.1
GNP—annual rate—$ billion	1st qtr.	422.0	429.9	− 1.8

Significant changes: Kwhr sales for April dropped under a year ago level for the first time since the recession began, but industrial production jumped up again in June.

Get the most out of
Power-Groove with Day-Brite

CFI-15 fixtures for two 8-foot Power-Groove lamps furnish 60 foot-candles in high-bay areas of the All-Steel Equipment Co., Aurora, Ill. Under balconies, CFI-10 fixtures for High-Output Rapid-Start Lamps are used. HATFIELD ELECTRIC CO., *Electrical Contractor.*

Take advantage of the greater light output provided by Power-Groove lamps—*plus* the traditional installation and maintenance economies built into every Day-Brite fixture.

You get *both* when you install Day-Brite CFI (Comfort For Industry) industrial fixtures designed specifically for Power-Groove lamps.

Whether you have a high-, medium- or low-bay lighting problem, there's a Day-Brite CFI fixture to fit your requirements. For information, call your Day-Brite representative listed in the Yellow Pages, or write for Power-Groove booklet. Z-151

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DAY-BRITE
Lighting Fixtures

Day-Brite Lighting, Inc., 6270 N. Broadway, St. Louis 15, Mo.
Day-Brite Lighting, Inc., of Calif., 530 Martin Ave., Santa Clara, Calif.

NATION'S LARGEST MANUFACTURER OF COMMERCIAL AND INDUSTRIAL LIGHTING EQUIPMENT

'Thermo-Electrics' May Open New Sales Vistas

Westinghouse introduces new appliances that both heat and cool, using 'Peltier effect'. Many new applications planned

In the plush Vanderbilt Room of Manhattan's Biltmore Hotel one day last week, Westinghouse Consumer Products VP C. J. Whitting rose before a press group and in a matter of minutes opened up a whole new era of electric product and equipment innovation.

Whitting's key: "Thermo-electric" appliances that both cool and heat, that are silent, vibrationless, and have no moving parts.

Actually, there's nothing new about the principle upon which the new Westinghouse appliances—at the moment, a baby bottle warmer-cooler and a hostess cart with refrigeration and oven compartments—are based. Known as the "Peltier effect", it was discovered in 1834 by French physicist Jean Peltier, and states that when a current is passed through the junctions of two dissimilar materials, one junction will get hot and the other cold, depending on the direction of flow. And the principal is reversible: if heat is applied to one junction, an electrical current is generated. The problem has been to find suitable materials — probably semiconductors—for the best heating or cooling efficiency. Westinghouse is keeping theirs a secret.

Whitting went on to sketch the range of domestic and commercial applications—from refrigerated mixing bowls to central heating and air conditioning. "The number . . . is almost infinite," he said. But he cautioned that many practical problems remain to be solved before they will be on the market.

THERMO-ELECTRIC BOTTLE WARMER with timer to shift from heating to cooling cycle is set by Westinghouse VP Chris J. Witting. Note bottle at right

What Meaning for Utilities?

What does all this spell for utilities? For one thing, thermoelectric appliances, once they are available commercially, "could easily double" the $1 billion worth of appliances sold yearly, according to Westinghouse. Efficiencies at present are about the same as those for compressor equipment. Power factor, however, may be another consideration. Thermo-electrics will operate only on dc: they require and have built-in rectificers. With enough of them in a house, they could change the electrical characteristics at the meter.

But all that is a long way off. What is important is that a whole new unlimited range of electrical applications has been opened up—another loadbuilding milestone.

Promotion Ideas Detailed in LBE Handbook

Tested merchandising techniques to sell electrical appliances, products and equipment have been compiled in a 24-page brochure, the Retail Promotion Handbook, by Live Better Electrically.

Successful local level promotions by dealers, electrical leagues, distributors and department stores have been detailed to suggest various ways electrical products can be merchandised at the point-of-sale. The brochure also presents a checklist of 12 retail promotion ideas and a 13-point plan for LBE community-wide promotions. Local home shows and the Medallion Home Program are also examined.

The Handbook was created "to meet the need expressed in many quarters for a pertinent compendium of successful Live Better Electrically promotions."

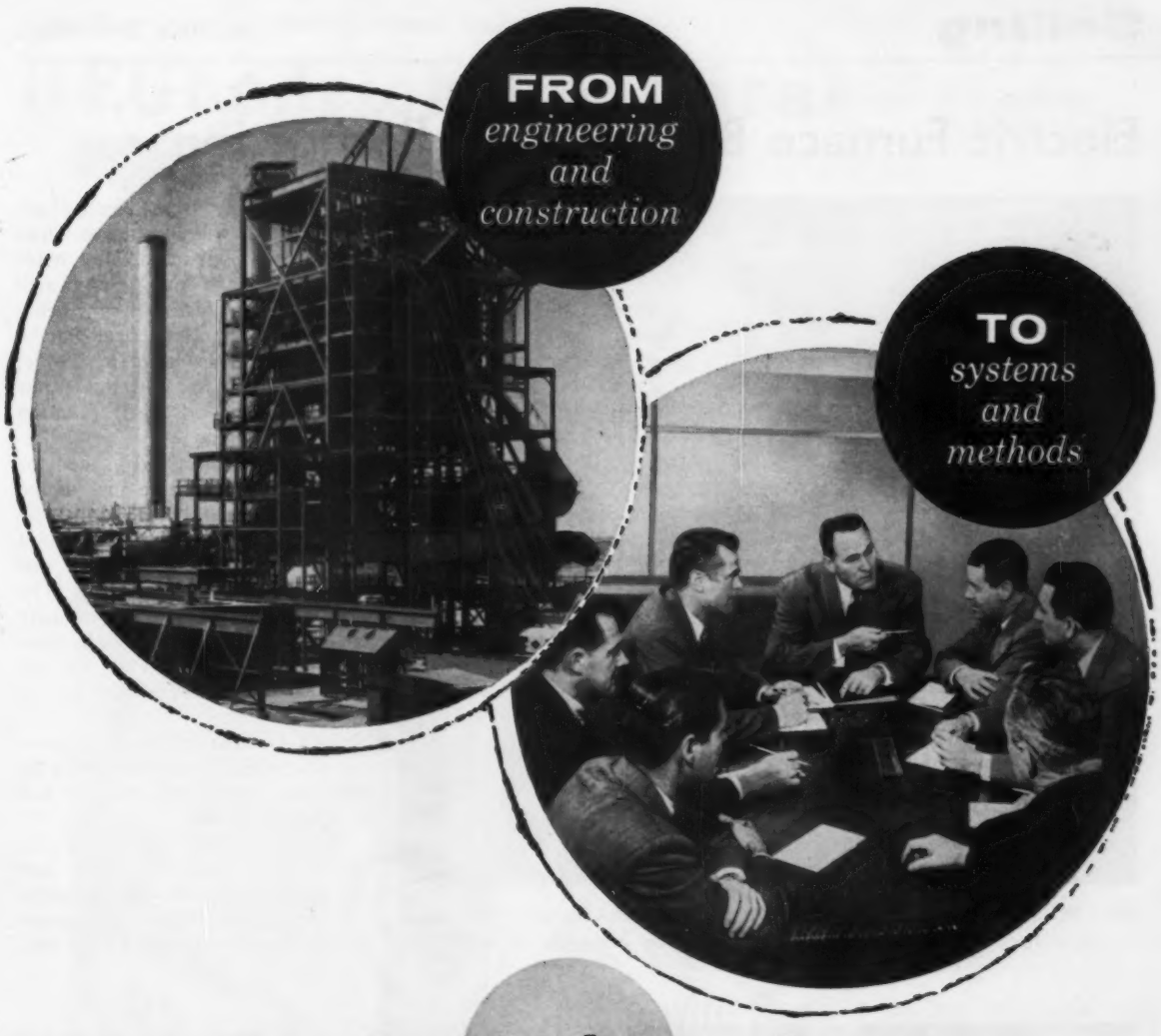
Distribution has been to retailers, distributors, electrical leagues, utilities and trade allies.

Order from: Live Better Electrically, 239 Great Neck Rd, Great Neck, N. Y. Price: 10¢ per copy.

New NLB Course Offer

The National Lighting Bureau is now offering its industrial and commercial lighting training course for contractors and other lighting salesmen without the former requirement of adopting an entire lighting promotion program. The course includes technical aspects of calculation and layout and sales methods. For information write, National Lighting Bureau, 155 E. 44th Street, New York 17, N. Y.

(*More Selling on page* 118)



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One of these services—*accounting and office systems and methods*—helps companies meet the challenge of ever-increasing complications and costs in this important area of operations. An Ebasco methods improvement program can help point the way to better service and lower costs for your company. These programs are based on years of concentrated experience with companies large and small—and backed by continual research in new methods and up-to-date machine equipment.

For more information about our accounting and office systems and methods services, write: Ebasco Services Incorporated, Systems and Methods Department, Two Rector Street, New York 6, N. Y.

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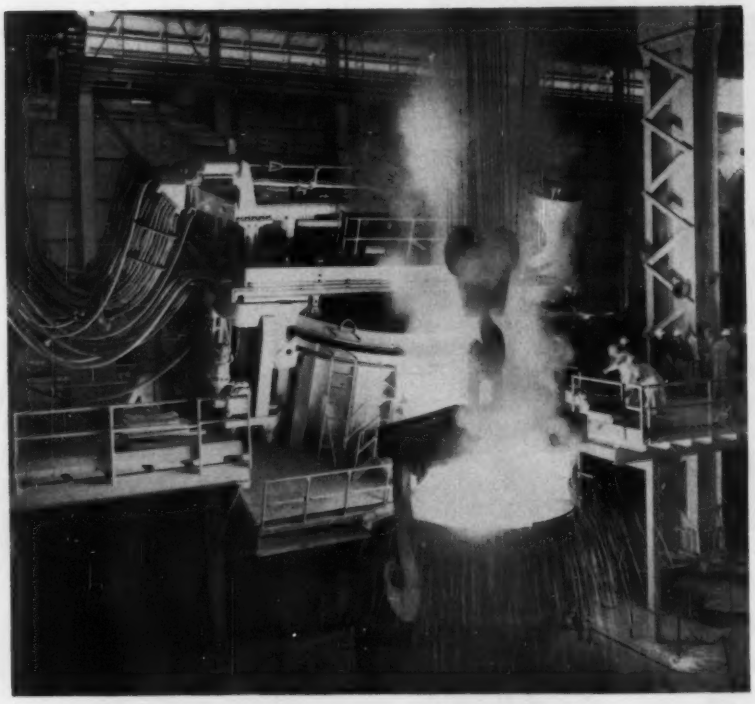
Electric Furnace Boosts Steel Production



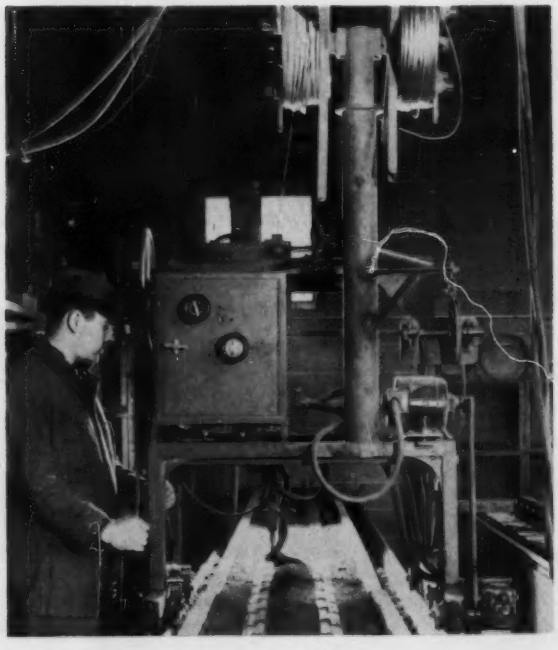
FIRST POUR is made from new 100-ton electric arc steel furnace. Time for a complete heat is only 4½ hr. Power consumption averages 16 to 20 Mw

Two new 100-ton electric arc furnaces that will increase production by 70% but require less manpower than the five open-hearth furnaces they replace are now being installed at the Bethlehem Pacific Coast Steel Corp. plant in Seattle, Wash. The new units are the largest electric steel-making furnaces in the 11 western states.

Said to be particularly suited for a scrap metal operation such as the Seattle plant, they take only 4½ hr for a heat, from the time the first scrap metal is inserted until the molten steel is ready to pour. The two new units will have a capacity of 420,000 tons per year, compared to 246,000 tons for the five oil- and gas-fired units they are replacing.

Each furnace will have an average power requirement of 16 to 20 Mw; peak power requirements will be up to 37.5 Mw.

Bethlehem Pacific Coast is also installing a 32-in. blooming mill and modernizing two existing mills. On completion, these mill operations will use an additional 10 Mw.



Welders Repair Bearings Economically and Quickly

ALBERT J. McCUBBIN, Industrial Sales Engineer, Baltimore Gas & Electric Co, Baltimore, Md.

Automatic, continuous electric welders at the Tru-Rol Co in Baltimore, have proven an economical, fast, and efficient method of applying high alloy surfaces to worn friction-bearing components—rollers, idlers, tractor treads—of rail assemblies and lower carriages of heavy construction apparatus.

The repaired surfaces are superior in quality and are said to outlast the original ones. They are uniformly hardened throughout, to depths of ⅜ to ½ in., compared to $\frac{5}{16}$ max. on the new ones. Cost of the electric rebuilding is only a fraction of cost of replacement parts. Since the metal is applied evenly, machining is unnecessary. No craters are formed if the welding is interrupted.

Tru-Rol uses five transformer type welders, each rated 600 amp, and one motor generator welder rated at 300 amp.

Another new development using

B.F.Goodrich Chemical *raw materials*

"Zippertubing" is produced in standard lengths from 25 to 1000 feet, in varying sizes and colors, by The Zippertubing Company, Los Angeles. Shielding material used in it is manufactured by Cordo Chemical Corporation. B.F. Goodrich Chemical Company supplies the Geon polyvinyl material.

New shielding and jacket made with Geon can be zipped on in a single operation

Production and maintenance of wire harnesses are greatly simplified with this new shielding and jacket combination made with Geon polyvinyl material. All you do is zip it on. Saves time and equipment during manufacture—makes it easy to replace the jacket if it has to be removed to get at wiring for service.

For regular RF shielding, glass cloth saturated with Geon polyvinyl material is laminated to aluminum foil. It gives 100% coverage to provide immediate grounding of RF and UHF interference. The outer surface, also of Geon, has zipper tracks sealed in. A pull tab can easily be used to facilitate closure.

For heavier magnetic shielding, special steel foil is laminated between layers of Geon. Lead saturated glass cloth is available for radiation problems.

Geon provides high insulation resistance, heat stability and extra strength, as well as accuracy in molding. It's another example of versatile Geon proving the key to a dramatic new product. For information, write B.F. Goodrich Chemical Company, Dept. LR-8, 3135 Euclid Avenue, Cleveland 15, Ohio.

B.F.Goodrich Chemical Company
a division of The B.F.Goodrich Company

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GEON polyvinyl materials • HYCAR American rubber and latex
GOOD-RITE chemicals and plasticizers • Harmon colors

News About People

Sanders Becomes Vp

Middle South Utilities has elected Harold F. Sanders vice president, secretary and member of the board of directors. In another promotion, Donald J. Winfield was made treasurer.

Sanders was formerly secretary and treasurer of Middle South, a position he stepped into when the utility was organized in 1949. Previously he had served in the same capacity with the Electric Power & Light Corp, a predecessor company of Middle South.

The new vp is active in a number of organizations, including the American Management Association and EEI, serving the latter as a member of the planning and investor relations committee.

Winfield, new treasurer, has been with the company since 1956.

Calectric Elects Phipps Vp

Gerald H. Phipps has been elected vice president and treasurer of California Electric Power Co, succeeding John R. Gilbert, who has retired from the company after 36 years of service.

Phipps, a Williams College graduate, was elected to Calectric's board of directors in 1950, and later became a member of the utility's executive committee. He continues to hold both these positions in addition to his new duties.

Active outside the company, he is president of his own contracting firm located in Denver, and also devotes much time to the sports world. He is a member of the board of directors of the Denver Bears, professional baseball team and vp, American Horseshows Association.

GE Advances Belanger

General Electric Co has appointed John W. Belanger general manager of the apparatus sales division, succeeding the late William V. O'Brien, who died last month.

In his new capacity Belanger, who is also a GE vice president, will direct the sales, installation and service activities of some 50 departments, with products ranging from electric motors to giant turbines.

He began his GE career as a student engineer in 1917, later holding many engineering and sales positions. In 1943 he became manager of the federal and marine divisions, in 1947 manager of turbine divisions, and in 1951 was made head of the large apparatus division and a vice president.

Lagrone, Mills Promoted

P. T. LAGRONE

P. T. Lagrone has been made manager of the newly created New Orleans district of Westinghouse Electric's apparatus division. Stepping into Lagrone's vacated position as manager of the company's electric utility sales department is C. W. Mills.

Lagrone, who had been manager of electric utility sales since 1955, is a former Mississippi P&L employee.

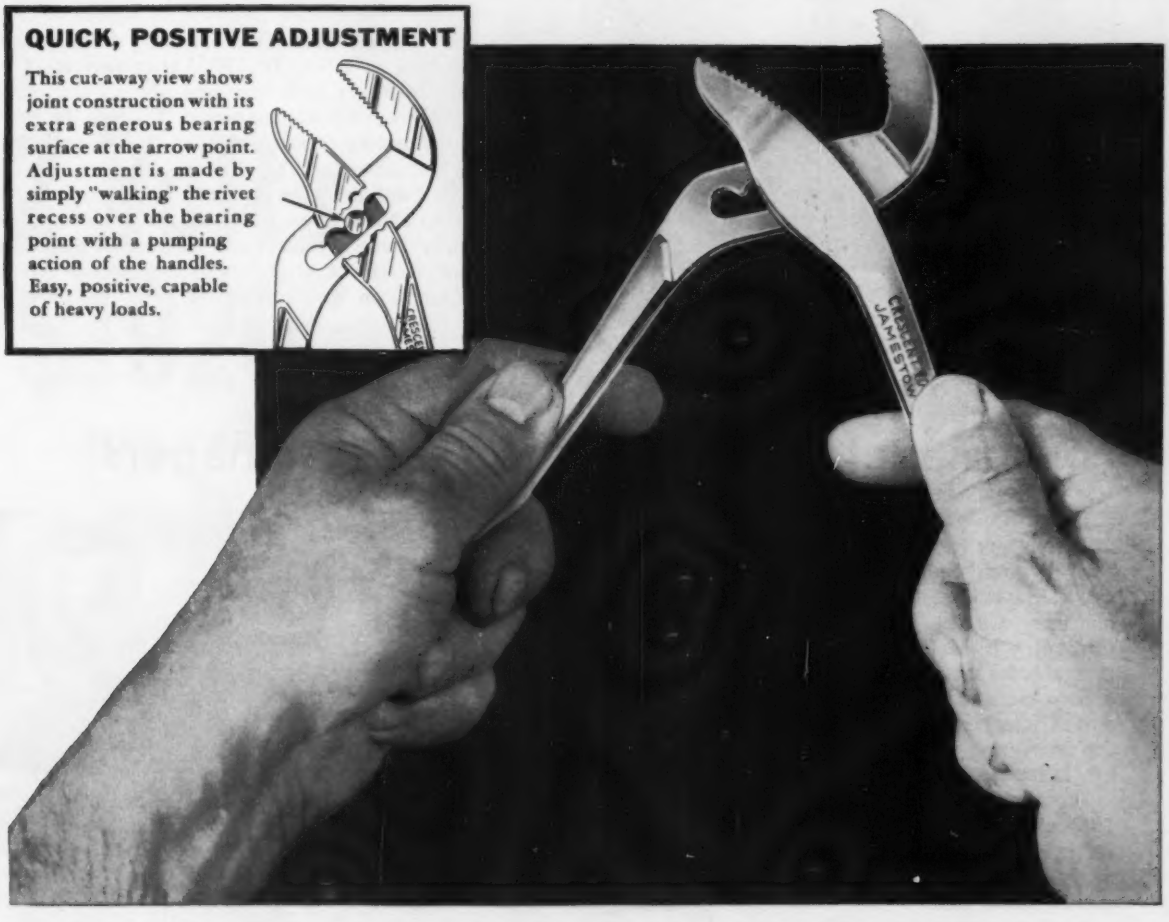
Mills, formerly Chicago area sales manager, has been with the company since 1940. He is a member of AIEE.

C. W. MILLS

Not only stronger and thinner . . . but
EASIER TO ADJUST

QUICK, POSITIVE ADJUSTMENT

This cut-away view shows joint construction with its extra generous bearing surface at the arrow point. Adjustment is made by simply "walking" the rivet recess over the bearing point with a pumping action of the handles. Easy, positive, capable of heavy loads.



So easy that after a little practice it can be done with one hand. Yet once adjusted to any of its four positions, Crescent's P210 Utility Plier just won't slip under severe loads. Yes, here's a 12 ounce plier that performs like a pipe wrench . . . is *stronger* than any other Utility plier . . . *thinner* than any other Utility Plier . . . and retails for only $3.00.

No. P210 will grip flat, square, hex or round objects up to 1½". It measures 9½" overall and is finished in rust-resistant zinc plating.

Crescent is our trade-mark, registered in the United States and abroad, for wrenches and other tools. Sold by leading distributors and retailers everywhere and made only by

CRESCENT TOOL COMPANY, JAMESTOWN, NEW YORK

Union Carbide, Federal Pacific Name Vp's

STROTHER ROBY

In recent promotions Dr. Corneille O. Strother was elected vp-research, Union Carbide Nuclear Corp, and Frank H. Roby became executive vp, Federal Pacific Electric Co.

Strother received his PhD in chemistry from Princeton University in 1933. In 1935, after two years of post-doctorate study both here and abroad, he joined Union Carbide as a research chemist. Through the years he has administered research posts of increasing importance for the company.

Roby, a Purdue University engineering graduate, is a former vp and director of the Square D Co.

Currently a vice president and member of the board of directors of NEMA, Roby is also a member of AIEE, and the American Welding Society.

Four Manufacturers Name Sales Managers

Leon B. Wohlgemuth became sales manager for the tubular products division, Babcock & Wilcox Co; S. Manuel Pearl was made sales manager, Circle Wire & Cable Corp; Roy E. Mullin stepped up to general sales manager, D. W. Onan & Sons Inc; and Mitchell P. Kartalia moved into position as manager of the marketing division, Square D Co, in recent sales promotions.

WOHLGEMUTH B&W PEARL Circle W&C MULLIN Onan & Sons KARTALIA Square D

Wohlgemuth joined B&W in 1936 after graduating from the University of Pittsburgh. He was formerly manager of the company's middle states sales.

Pearl has been with Circle Wire & Cable since 1956. He has been in the electrical industry for over 35 years, and with Circle since 1956.

Mullin replaces Hiram Hascall, who has retired at Onan & Sons. Formerly in the automotive field, he is a newcomer to the electric industry sales field.

Kartalia joined Square D in 1940. Succeeding Frank Roby (see article above) he was formerly manager of distribution equipment sales.

Allis-Chalmers Promotes Three in Advertising, Sales

PARKER TOFTE MURPHY

Allis-Chalmers Manufacturing Co. has elevated Charles W. Parker to the newly created position, director of sales promotion in company's Industries Divisions. A. R. Tofte was made manager of the publications and industrial press department, while J. W. Murphy advanced to manager, advertising department.

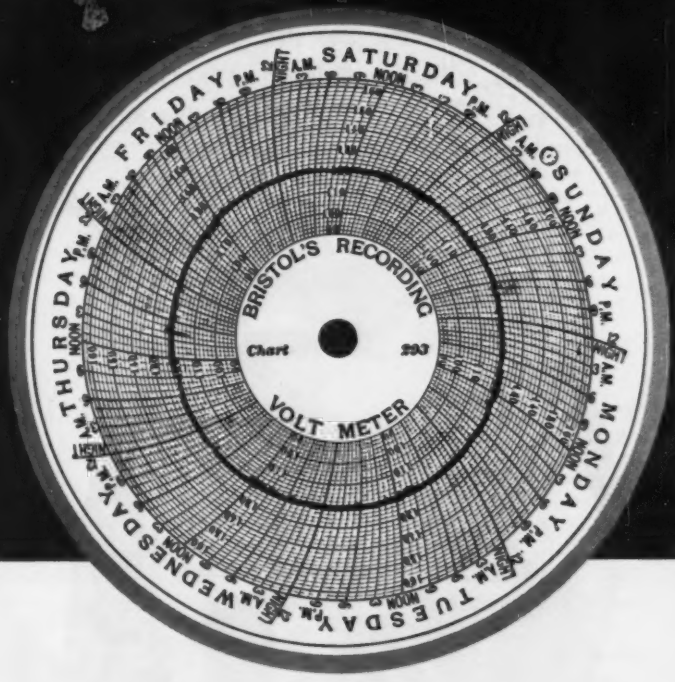
Parker, with the company since 1947, formerly served as Philadelphia district manager.

Tofte was formerly manager of advertising and industrial press department, while Murphy is former assistant manager, advertising.

ALLIS-CHALMERS . . . 25 years of leadership in 5/8% regulators

2 Volts = $1920*

per year



Here's how revenue loss is cut by holding a 2-Volt Band

MANY feeders are averaging high voltages during low load periods with low voltages during high load periods. The average may look good on paper. *But the result is a net loss of revenue!*

Regulating within a narrow 2-volt band width increases effective voltage, especially during the time of greatest load without changing the *average* voltage.

Each 1-volt increase in effective voltage increases revenue $960 on average feeder. Allis-Chalmers ⅝% step regulators hold a narrow band width of ±¾ volt.

For the complete story, call your nearby A-C office, or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.

*** Based on following factors:**

Peak demand — 2000 kw . . . Average demand — 800 kw . . . Annual load factor — 40% . . . Percent lighting and manually controlled heating — 30% . . . Value of kwhr — 3.4¢ . . . Power consumption varies as 1.6 power of applied voltage.

Originators of 5/8% Step Regulators

ALLIS-CHALMERS

A-C ALLIS-CHALMERS

A-5727

I wish we had more personnel and time to prepare this study for a new power plant and site.

Your regular staff is overloaded now. Call in the specialists and let them carry the peak load. How about Pioneer?

Give your non-routine operations to Pioneer

Design and Consulting Engineering Services. Pioneer has specialized in designing power plants for 56 years. It offers design service for fossil fuel, hydro and atomic plants. It will also assist in forecasting load growth, in site selection, in purchasing and expediting of equipment and in supervising construction. Pioneer's other services include substation, transmission and distribution studies and design.

Services in Regulatory Matters. Pioneer offers its services in all phases of Federal, State and Local regulation including the rate base, depreciation analysis, cost of service studies, market analysis, certificate proceedings and rate of return.

Corporate Services. Pioneer's services in corporate matters include business and management engineering advice, financial, accounting and tax counsel and insurance and pension plans and programming. It maintains a complete stock transfer, ledger and dividend disbursement service.

NEW!

On your letterhead, write for 40-page booklet, "Pioneering New Horizons in Power". Describes Pioneer's engineering services, and corporate services, from financing to operation.

56 YEARS

Pioneer Service & Engineering Co.

231 SOUTH LA SALLE STREET, CHICAGO 4, ILLINOIS

SALES ASSIGNMENTS

De Laval Steam Turbine Co has announced four changes in its sales staff: C. E. Cromwell has been appointed manager of commercial sales, in addition to his duties as field sales manager. A. L. Foltz Jr was named manager of the Chicago district office. J. F. Donovan is new manager of the Detroit district office, and W. H. Mouquin takes over as manager of the newly-established New York office.

Federal Pacific Electric Co has promoted four regional sales executives in the South and Southwest. Those advanced were W. L. Sullivan, to Southeast regional manager; Glenn Ellis, to Dallas district manager; Ted Beyert, to Houston district manager; and Felix W. Truss, Jr, to Kansas City district manager.

I-T-E Circuit Breaker Co has created two new sales staff positions, naming H. David Honan manager, industrial sales, and Arthur G. Curtin as manager, contractor sales.

J. A. Weaver Co has selected Glen P. Stearns Co, Columbus, as their representative for Ohio.

Kellogg Switchboard and Supply Co has appointed J. O. Smith division sales manager of the western region, where he will direct sales of eight states, Alaska, Hawaii and British Columbia.

Reliance Electric and Engineering Co's new branch manager for its Tampa sales office is Edwin R. Campbell.

Sierra Electric Corp recently named J. L. (Jack) Quisenberry assistant sales manager. He will be responsible for all phases of Sierra's sales activities, with special emphasis on integration of advertising and sales.

Sylvania Lighting Products announces the appointment of Louis P. Robinson as sales supervisor in the Atlanta district.

K. A. Vaughan has been designated as manager of product applications for the Industrial Division of Gould-National Batteries.

NEW LITERATURE

EEI PUBLICATIONS:

Specifications for Full-Length, Non-Pressure, Preservative Treatments of Poles (Hot and Cold Submersion Processes). TD-100.

Specifications for Porcelain Wireholders. TD-24.

Guide for Specifications for Revenue Metering Facilities Installed in Metal-clad Switchgear. No. 58-5. $0.25.

Specifications for Eye Bolts. TD-4.

Cable Operation, 1955. No. 57-11. $0.70. Non-members, $1.90.

A-C Network Operations, 1953-1955. No. 57-8. $1.00. Non-members, $2.50.

Edison Electric Institute, 750 Third Ave, New York 17, N. Y.

GE PUBLICATIONS: Order from General Electric Co, Schenectady 5, N. Y.

Fluorescent Floodlights: Bulletin GEC-1487, 4 pp, describes key features and operating characteristics of Fluoroflood Fixtures for highway guide signs, service stations, building fronts, poster panels, etc.

Code Selector Supervisory Equipment: Description, operation and application of supervisory control equipment for master and remote stations, a-c switching stations, hydro generating stations, and pumping stations are detailed in 20-p bulletin GET-2738.

Medium Transformers: RM medium transformers with RM-ASA ratings of 501-5,000 kva, single phase, and 501-10,000 kva, three phase, 69 kv and below, are featured in Bulletin GEA-6108B, 32 pp.

Insulating Materials: Bulletin GER-1467, 12 pp, describes characteristics and application range of insulating materials which are chemically, physically and electrically compatible.

Rural Lighting: Data and operating information on lighting fixtures for rural applications are explained in 6-p bulletin GEA-6703.

Submersible Pumping Motors: Bulletin GEA-6707 has data on servicing, ratings and dimensions of motors for deep-well, water-pumping, from 7½ to 125 hp.

Motor-Generator Sets: Bulletin GEA-6809 describing vertical high frequency motor-generator sets includes ratings and dimensions.

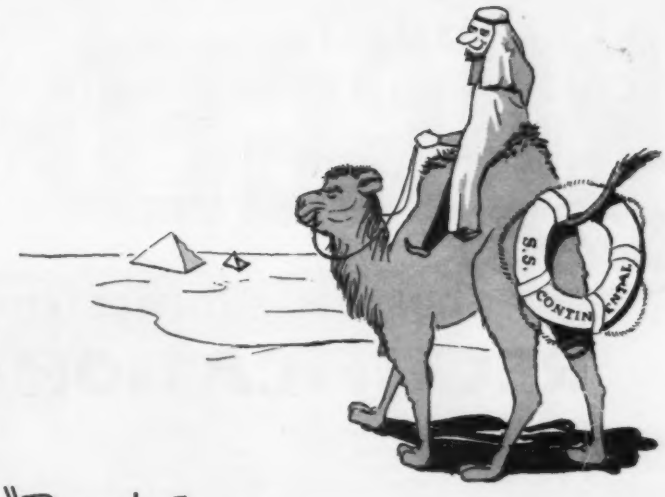
Weather-Protected Motors: 4-p bulletin, GEA-6721 describes weather-protected motors, available from 250 hp and up for both indoor and outdoor year around operation.

Floodlights: Key features of 1,500-w general-purpose floodlights, including dimensions and photometric data, are described in 2-p bulletin GEC-1488.

Mercury Luminaires: Bulletin GEC-1491, 2 pp, provides application information on "Power Pack" luminaires.

Regulators: Substation-type regulators for series street lighting circuits, are described in 4-p bulletin GEC-1489. Wiring diagrams and connection diagrams are included.

(*Continued on page* 126)



"Pays to be on the safe side... mirages, you know"

Back in 1945 when we started out in the photoelectric lighting control business, we (too) bent way over backwards in favor of precautions. One such life preserver — time delay — is still around. Although we did and still do supply controls with it, experience has proved that time delay is about as useful as a life preserver in the desert.

Theoretically, time delay is a safeguard against street lights being turned off at night as a result of a lightning flash, car headlight or helicopter tail light. In those early days, when a single control was probably mounted close to the ground and switched hundreds of lights, accidental turn-off was something too horrible even to contemplate. Time delay was supposed to minimize this.

Now, the growing practice of using one control per light, mounting controls higher in the air — and the facts — have convinced us that time delay is an extractable luxury. In those rare cases where a control gets mounted right in line with somebody's beacon or headlights, reorienting a delay-less control a few degrees solves that problem.

As for lightning flashes (one of the more popular "reasons" for time delay) considerable field experience has been accumulated on more than 2000 Fisher-Pierce controls. Some of these controls were a new design with a fraction-of-a-second delay, others were standard design without time delay and built especially for this experiment. Not a single turn-off as a result of a lightning flash has been reported. You might be as surprised as we were to discover that a lightning flash lasts only about 1,000 microseconds and its light intensity, measured at the control, doesn't begin to approach a value great enough (for a long enough time) to trigger a Fisher-Pierce control.

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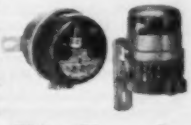

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(*Continued from page* 125)

Generators: Engine-driven, low-speed synchronous generators of up to 450 rpm are described in 8 p bulletin, GEA-5299B. Examples of typical services performed by these motors which feature Polyex ground insulation systems and new constant-pressure brush holders are illustrated.

Stack rack capacitor equipments: Bulletin GEA-6796, 8 pp. describes stack racks designed to supply bulk kilovars on transmission, subtransmission and distribution circuits. Detailed information on selection, application, installation and protection of these equipments is included.

AIEE PUBLICATIONS:

Recommended Practice for Toroidal Magnetic Tape Wound Cores. No. 430. Free.

Section 20 Overhead Type Distribution Transformers. C57.12c. $2.00.

Section 40 Secondary Network Transformers. C57.12. $0.80.

Partial Revision and Supplement to C57.12—1956. C57.12d. $1.00.

Current-Limiting Reactors. C57.16. $1.50.

Guide for Making Dielectric Measurement in the Field. No 62. $1.00.

Illuminating Engineering. C42.55. $0.60.

American Standard Requirements for Power Circuit Breaker Control. No. C37.11. $0.80.

Presenting Data on Magnetic Amplifier Core Materials. No. 431. Free.

Test Code for Power-Factor Testing of Mineral-Oil-Insulated Instrument Transformers. No. 75. Free.

Graphical Symbols for Semiconductor Devices. No. 426. Free.

American Standard Electrical and Dimensional Characteristics of Outdoor Apparatus Bushings. C76.1a. $0.50.

American Institute of Electrical Engineers, 33 W 39th St, New York 18, N. Y.

• **CONTROL SYSTEMS:** 16-p bulletin 1029 gives complete engineering description and illustration of Selective-Sequence and Automatic-Sequented insert-type panel controllers. A list of typical installations shows a variety of applications. Copes-Vulcan Div, Blaw-Knox Co, Erie, Pa.

• **STEAM TURBINE:** 40-p bulletin 03B7654A covers design and construction features of WA-series steam turbine generating units rated 2,000 through 16,500 kw. Allis-Chalmers Mfg. Co, Milwaukee 1, Wis.

• **BACKHOES:** Form LXCH-1-58 describes the features and specifications of truck-mounted backhoes for Chevrolet trucks. Form LX-1-15M-458 describes features of a tractor-mounted backhoe. Ottawa Steel Div, Young Spring & Wire Corp, Ottawa, Kan.

• **LIGHTING HANDBOOK:** 250-p pocket-size manual has chapters on interior wiring, school and office lighting, store lighting, industrial and architectural lighting, floodlighting design, and street and sign lighting. $3.00. Lamp Div, Westinghouse Electric Corp, Bloomfield, N. J.

Minimize Fluctuations

(*Continued from page* 87)

sized transformer are shown. Negative reactance which can be obtained is limited to small values by practicable proportions and limits on the total transformer impedance.

For two sets of frequency changing loads supplied at different voltages, a four-winding transformer can be built that has one secondary winding which will have substantially constant voltage. The primary winding H and secondary winding A, B and C, are shown in Fig. 2.

In the equivalent circuit, H is the supply winding, A the constant voltage winding, and B and C the windings carrying the changing loads. Cross section of a suitable winding arrangement and typical values of reactance for such winding arrangements are shown.

Because a load on winding B produces a negative drop between terminals H and A, voltage on A will rise through the transformer if a load is placed on B. Also, because a load on winding C produces a total negative drop between terminals H and A, voltage on A will rise through the transformer due to a load on C. Voltage on A, therefore, will rise slightly due to any combination of loads on B and C if there is no high voltage line drop. Therefore, an increase in load on either B or C or both will cause an increase in voltage A.

Commission Starts Program on Services It Regulates

In Wisconsin the Public Service Commission has undertaken an information program to present statistics on the services which the commission regulates. The information was described by a skeptical Capital Times reporter as "publicity apparently aimed at backing up its decisions granting rate increases . . ."

Included in the information are charts and graphs showing disposition of the average revenue dollar collected by utilities, proportion of taxes paid by them out of consumers bills, and increases in utility rates compared with hikes in other consumer goods and commodities.

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The Meetings Calendar

AUGUST

Southeastern Electric Exchange Public Utility Executive Course—Georgia Institute of Technology, Atlanta, Ga., Aug. 4-29.

American Institute of Electrical Engineers—Special Technical conference on Non-Linear Magnetics and Magnetic Amplifiers, Hotel Statler, Los Angeles, Aug. 6-8; Pacific General Meeting, Sacramento, Calif., Aug. 19-22.

The Institute of Radio Engineers—Conference on Electronic Standards and Measurements, NBS Boulder Laboratories, Boulder, Colo., Aug. 13-15.

Illuminating Engineering Society—National Technical Conference, Royal York Hotel, Toronto, Canada, Aug. 17-22.

SEPTEMBER

Edison Electric Institute—Accounting Division and Section Organization Meeting, sponsored jointly with AGA, Netherland Hilton Hotel, Cincinnati, Ohio, Sept. 8-9; Industrial Power & Heating Group, Wisconsin Dells, Wisc., Sept. 18-19; Meter and Service Committee, Driscoll Hotel, Corpus Christi, Texas, Sept. 22-24; Industrial Relations Committee Round Table Conference, Hotel Drake, Chicago, Ill., Sept. 29-Oct. 1

Northwest Public Power Association, Inc—Power Use Section Annual Meeting, Malaspina Hotel, Nanaimo, British Columbia, Sept. 10-12.

Maryland Utilities Association—34th Fall Conference, The Cavalier-Sir Walter Raleigh Hotel, Virginia Beach, Va., Sept. 12-13.

Rocky Mountain Electrical League—Annual Fall Convention, Jackson Lake Lodge, Moran, Wyo., Sept. 14-17.

American Institute of Electrical Engineers—Power Industry Computer Application Conference, King Edward Hotel, Toronto, Canada, Sept. 15-17.

Instrument Society of America—13th Annual Instrument, Automation Conference & Exhibit, Philadelphia Convention Hall, Philadelphia, Pa., Sept. 15-19.

World Power Conference—Sixth International Congress on Large Dams, Statler Hotel, New York City, Sept. 15-20.

Pennsylvania Electric Association—51st Annual Meeting, Penn Sheraton Hotel, Pittsburgh, Pa., Sept. 17-18.

Northwest Electric Light & Power Association—51st Annual Meeting, Sun Valley Lodge, Sun Valley, Idaho, Sept. 17-19.

Public Utilities Association of the Virginias—40th Annual Meeting, Greenbrier Hotel, White Sulphur Springs, W. Va., Sept. 18-21.

American Society of Mechanical Engineers—Power Division Conference, Hotel Statler, Boston, Mass., Sept. 28-Oct. 1

OCTOBER

Indiana Electric Association—Annual Convention, French Lick-Sheraton Hotel, French Lick, Ind., Oct. 1-3.

Electric Companies Public Information Program—Workshop Conference, Radisson Hotel, Minneapolis, Minn., Oct. 1-3.

Edison Electric Institute—Prime Movers Committee, Hotel Statler-Hilton, Buffalo, N. Y., Oct. 6-8; Transmission & Distribution Committee, Hotel New Yorker, New York City, Oct. 9-10; Electric System and Equipment Committee, Hotel Barringer, Charlotte, N. C., Oct. 13-14; 5th Annual Area Development Workshop, Hotel Somerset, Boston, Mass.; Taxation Accounting Committee, co-sponsored by AGA, Tides Hotel and Bath Club, St. Petersburg, Fla., Oct. 22-24.

Wisconsin Utilities Association—Electric and Gas Operations & Sales Convention, Schroeder Hotel, Milwaukee, Wisc., Oct. 15-17.

MORE BIG DATES FOR '58

National Electrical Manufacturers Association—Annual Meeting, Atlantic City, Nov. 10-14.

National Association of Railroad and Utilities Commissioners—Annual Convention, Westward Ho Hotel, Phoenix, Ariz., Nov. 17-20.

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Response by contractors and home owners was excellent during both programs, contractors reporting a substantial increase in the number of wiring modernization jobs.

Houston Lighting & Power Company experienced an increase of 458 kilowatt hours per residential customer in 1957 over the previous year, which is believed to be the highest by any electric utility company.

**per urban residential customer*

To train electrical contractors to sell HOUSEPOWER, Houston Lighting and Power conducted a four-session training course.

"When everybody pushes, things really move! With the concerted efforts of utilities, their suppliers, manufacturers and contractors, HOUSEPOWER is sure to continue big gains", says H. E. Greenwalt, Executive Vice President and General Manager, Kuhlman Electric Company.

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